

The AMSAT[®] Journal

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July/August 2005



First Eagle Software Defined Transponder (SDT) QSO!
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**The AMSAT Symposium is October 7, 8, 9, 2005 in
Lafayette, LA. Are you registered?**

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This is the final call for papers for the 2005 AMSAT Space Symposium and Annual Meeting to be held October 7 - 9, 2005 in Lafayette, Louisiana. Proposals for papers and symposium presentations are invited on any topic of interest to the amateur satellite program.

We request a one-page abstract now. Camera-ready copy on paper or in electronic form are due immediately for inclusion in the printed Symposium proceedings. Abstracts and papers should be sent to n8fgv@amsat.org

Dan Schultz, N8FGV

**Have you registered for the
Symposium yet? See page 30
for all you need to register!**

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AMSAT is a non-profit volunteer organization which designs, builds and operates experimental satellites and promotes space education. We work in partnership with government, industry, educational institutions and fellow Amateur Radio societies. We encourage technical and scientific innovation, and promote the training and development of skilled satellite and ground system designers and operators.

AMSAT's Vision

Our Vision is to deploy high earth orbit satellite systems that offer daily coverage by 2009 and continuous coverage by 2012. AMSAT will continue active participation in human space missions and support a stream of LEO satellites developed in cooperation with the educational community and other amateur satellite groups.



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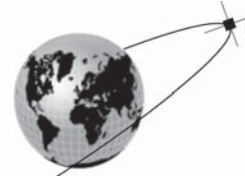
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APOGEE VIEW

by Rick Hambly, W2GPS • w2gps@amsat.org



I have just returned from a visit to Guildford, UK to attend the AMSAT-UK 2005 Colloquium. I thank AMSAT-UK and especially Jim Heck, G3WGM, Graham Shirville, G3VZV, and Prof. Sir Martin Sweeting, G3YJO, for making this a wonderful experience for me. I gave a presentation on the status of things at AMSAT-NA that was very much like my Dayton AMSAT forum presentation.

This is the second trip this year to Europe, the first being in January to an AMSAT-DL P3E design review meeting. These trips have impressed me with the diversity and quality of the AMSAT worldwide community. I met people from Australia, Russia, Israel, New Zealand and many European countries. We are already sharing resources, hardware and software between the AMSAT-DL P3E and AMSAT-NA Eagle projects. There are many more opportunities for international cooperation and joint projects that I hope will mature in coming months.

There is no shortage of opportunities for new operating experiences while our users wait patiently for the various High Earth Orbit satellites to be constructed and launched. While at the AMSAT-UK Colloquium, AMSAT-UK secretary Jim Heck, G3WGM, announced that PoSAT-1 (PO-28) will be returned to the amateur satellite service in the coming weeks. The operating mode is yet to be determined but regardless of the mode this will be a significant new asset for the amateur satellite service. Look at the AMSAT Web site (www.amsat.org) for the latest news and background information on PO-28.

A few days after my return from England the Space Shuttle successfully returned to space. During one of the three exciting space walks Astronaut Soichi Noguchi, KD5TVP, installed the Materials International Space Station Experiment 5 that includes the PCSat2 Amateur Radio payload on the exterior of the International Space Station. Early indications are that PCSat2 is working well. Congratulations to the US Naval Academy students who built PCSat2 and their advisor Bob Bruninga, WB4APR.

Time is getting short to register for the 2005 AMSAT Space Symposium to be held October 7-9 at the Holiday Inn Holidome in downtown Lafayette, LA. Information can be found on the Symposium Web page at

www.amsat.org/amsat-new/symposium/. Attendees can now register online through the AMSAT store at www.amsat-na.com/SymposiumReg.php. Registration for the Annual Banquet, the Friday Night Shrimp Boil and the Sunday Swamp Tour can all be done at the time you register for the Symposium. Please join us at this year's Symposium.

This year's AMSAT Board of Directors election has generated a great deal of interest. There are two candidates for every available seat of the Board, which I believe indicates a healthy excitement over the future of AMSAT. I hope each of you has taken the time to read over the candidates' statements, contact them with your questions and cast your ballots. Voting is your opportunity to participate in directing the future of AMSAT and is one of the most important benefits of your membership.

73,

Richard M. Hambly, W2GPS
 President 



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The World That Passed Us By

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Think back, if you are old enough (and if you're a member of AMSAT, demographics suggest you most likely are), to the exciting days of October, 1957. The world's first artificial satellite, Sputnik 1, had just been launched. It was launched by the USSR (they had been known by this acronym for two generations, although they were still collectively known as 'The Russians.'). The USSR, we Americans were told, were an enemy nation. The Russians were an enemy people. Our enemy was in space – we could hear them on 15 MC (this was in the days before MHz)! America was suddenly a paranoid nation (so what's new?)

Think back, if you are old enough (and if you're a ham, statistics suggest you most likely are), to the frantic days immediately post-Sputnik. The United States was trying frantically to play catch-up. Your high school guidance counselor was telling you, "You're good at science. You're good at math. Go and become an engineer; we can never have enough engineers to catch up to the Russians." (At the same time, you learn years later, your friend Sasha Zaitsev was being told by his high school guidance counselor, "You're good at science. You're good at math. Go and become an engineer; we can never have enough engineers to stay ahead of the Americans.")

Think back, if you are not yet senile (and if you're able to read this, there is still hope), to when you first got your ham radio license. The world that Sputnik had made smaller was suddenly shrinking even more. You could talk (OK, so it was probably via Morse code) to other hams, halfway around the world – maybe even to the dreaded Russians. Maybe they weren't your enemy after all.

Think back, if you are old enough (and if you've read this far, I know you are), to the excitement of December, 1961. With a little help from your USAF friends, hams had just launched OSCAR I, the world's first non-government satellite. You could hear it on 145 MC (this was still in the days before MHz)! Suddenly schools (the same ones that were training Americans to catch up with the Russians, and the same ones that were training Russians to stay ahead of the Americans) were activating ham radio clubs, building antennas, and pointing them ... up!

Now think back to last week. Surely you're old enough to have noticed your kid (or maybe your grandkid) Instant Messaging to his buddies in Russia. Maybe she doesn't remember what USSR stood for, but she knows all the countries in the world by their email suffixes. Never mind that those same international suffixes used to be ham callsign prefixes. What matters is that your offspring are talking to the world – by IM and e-mail and VOIP and cellphones – and yes, even by satellite links. Links invisible to them. Do you think they have any need for ham radio? Probably no more than we have need for spark. The world has passed us by.

Or has it? Are there still a few things we can still teach our kids, our grandkids, before they put us out to pasture?

I like to think there are.

Think forward to a world linked by a telecommunications infrastructure that rivals Science Fiction's boldest predictions. Every man, woman, and child carries a communicator (possibly implanted) that links him or her to everyone else on Earth. Instantly, and cheaply, via satellite. In whatever language the participants choose. You thought Paramount Studios held all the patents on the Universal Translator/Communicator? So did I. But it wasn't long before this technology permeated our society. And transformed it.

Now think about a civilization in decline. For generations, our descendants had taken for granted a technological base that unified their world. Nobody needed ham radio; it was obsolete, overtaken by progress. Nobody needed AMSAT; it was a vestige of a bygone era, a footnote in the history books. All anybody needed was to think the right words, and the neural interface self-activated, putting any individual in instant contact with any other, at the speed of thought. The omnipresent satellites were invisible not only to their eyes, but to their mind's eyes as well.

Until they began to fail. Our machines, like ourselves, are mortal. Suddenly, there was nobody on Earth who remembered Keplerian elements. There was nobody alive who remembered Maxwell's Equations. The global net fell silent and not a soul had a clue about how to fix it.

Fortunately, a group of anthropologists and historians remembered something from their school days. A primitive creature, cryogenically preserved, who had roamed the Earth in those prehistoric days when satellites were new, and Russians and Americans thought themselves enemies. A being who used ancient, stone-aged tools like Yagis and keyers and frequency synthesizers and digital signal processing, to force crude, low-data-rate communications between himself and other primitives.

So they thawed him out, and put him to work, and he saved the world.

He was a radio ham.

He was an AMSAT member.

He was you. 



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432 EME for Average Tropo Stations

by Daniel Gautschi, HB9CRQ/KT6Q,
dan@hb9q.ch

HB9Q (JN47cf) has been using their 15m dish (45ft) and 2 KW PA since April 2000. They have worked 310 initials during the past 5 years. With the introduction of the JT65 digital mode (by K1JT), EME became possible for small stations also on 432 MHz.

At HB9Q they are very successfully using JT65 on 144, 432 and 1296 MHz. Especially on 432 MHz they have worked several dozen QRP, not to say QRPP stations (see the list below for a few examples), using JT65C (previously JT44). For most of the stations it was the very first QSO on 432 MHz EME!

If your rig on 432 MHz has 1 Yagi (2m or longer) and 50W output (in shack, if the cable is not too long), you can work HB9Q pretty easily using JT65C, even on random contacts. You do not need a preamp to hear them on the speaker.

HB9Q usually announces its activities on the moon-net and on their home-page at: www.hb9q.ch. During their activities they are stand-by on the JT-logger. Besides JT65 they very much enjoy working CW and SSB.

If you would like to get a sked with them just send an e-mail to dan@hb9q.ch.

Give it a try and add a 432 MHz EME QSO to your log!

Examples of some QRP stations worked on 432 MHz EME by HB9Q can be seen on page 31.

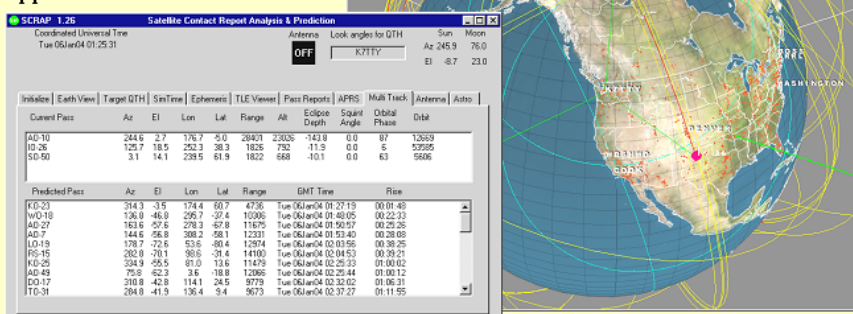


HB9Q Antennas

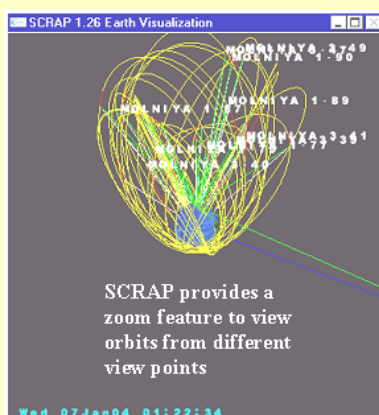


Satellite Contact Report Analysis Prediction

AMSAT is now the North American distributor of SCRAP, a tracking program designed for ham satellite applications for Windows 95+

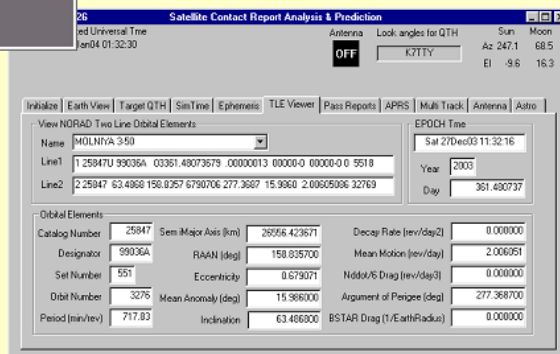


SCRAP provides a real-time contact report and display for over 2000 satellites on a Microsoft Windows 95+ Pentium platform.



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<http://www.amsat.org>

The author, Bill Bytheway, K7TTY donated SCRAP to AMSAT. All proceeds support AMSAT.

Free software upgrades and further information can be found at

<http://www.rtty.com/bytheway>



Florida University Satellite Competition

by Lee McLamb, KU4OS, ku4os@amsat.org

Many local schools and colleges have programs involving the construction of satellites which welcome and benefit from the assistance of AMSAT members. The students benefit from the experience and knowledge of AMSAT members. AMSAT also benefits in several ways as well. We establish contacts with potential volunteers for Eagle and other AMSAT projects, we improve the public image of AMSAT in the community and it is a lot of fun. In this article we'll look at FUNSAT¹, or Florida UNiversity SATellite.

Background

FUNSAT is a competition to design a satellite which fits the normal CubeSat² description by having a mass of 1 Kg and the size of 10 x 10 x 10 cm³ (~4 in.3). The primary objectives of this competition are to provide experience in developing, engineering and managing a project which

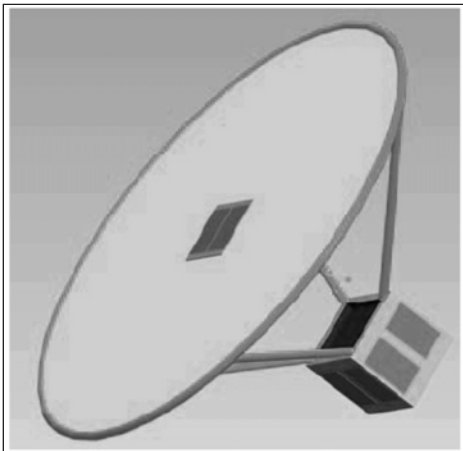


Figure 1: Deployed Inflate-A-Brake Concept
(Credit: UF Gossamer Gators).

involves varied disciplines of systems engineering, supporting a test-bed for advanced technologies, and promoting advanced study and career development for Florida students in the field of aerospace. The competition is funded by the Florida Space Grant Consortium (FSGC) with additional technical support provided by NASA, AMSAT and other members of the local space industry.

The Competition

The first annual FUNSAT competition began in the fall of 2004. The FUNSAT sponsors first contacted AMSAT through Area Coordinator, Dave Jordan, AA4KN, who referred them to me. They were looking for assistance with their IARU application for

frequency coordination and trying to understand the FCC rules and regulations. Since the FUNSAT sponsors had offices near Cape Canaveral AFS where I work, it was quite easy to meet with them to begin helping them understand the Amateur Radio and amateur satellite services. This first meeting also allowed me to learn what other assistance they might need.

Of the many groups that initially entered the competition, three submitted design packages for review in December of 2004. Those three teams were from Embry-Riddle Aeronautical University (ERAU), University of Central Florida (UCF) and University of Florida (UF).

ERAU's "Strike-Eagle"³ is a satellite designed to gather data on the frequency and magnitude of lightning strikes around the world using frequencies at 13 and 26 MHz during a 100 day mission. UCF entered with their Laser Communications and Energy Transfer Orbiter⁴ satellite which aimed to demonstrate new manufacturing technology, 3-axis stabilization, an internal wireless LAN as well as providing spacecraft power from and communicating with a ground based laser. UF chose to tackle the problem of orbital debris by developing an "Inflate-A-Brake"⁵ for deorbiting CubeSats when their mission has been completed.

These three teams were invited by the FUNSAT sponsors to a workshop held in the Astronaut Memorial Foundation Building at Kennedy Space Center (KSC) in January 2005. At the workshop each team presented their project. There was also a presentation from the CubeSat program explaining the overall program as well as providing some of the specific details about how the final integration would be done. AMSAT was also invited to speak at the workshop and I

presented a talk titled, "The Amateur Satellite Service: Regulation, Coordination and Cooperation". This talk focused on explaining FCC's role as a regulator, what rules apply and how that role is different from the roles of AMSAT and the IARU who work in coordination and cooperation. The presentation also encouraged the participants to become involved both in AMSAT as well as their local Amateur Radio organizations. Following the presentations, lunch was provided by the FUNSAT sponsors, which gave everyone a chance to exchange ideas and get feedback on the projects.

The teams then returned to their schools to further develop their projects and prepare for the final judging to be held at the second workshop in May. All the teams made significant progress during the next four months with both ERAU and UF submitting final design reports for judging. AMSAT again assisted the sponsors by reviewing the reports and providing feedback and comments.

The UF team made impressive progress with their Inflate-A-Brake. They had prototyped a storage bin and deployment mechanism and also tested the inflation in a vacuum chamber. The storage bin is designed to replace one face of a CubeSat and is only 18 mm (~0.7 in.) thick. Modeling of the increased drag from the Inflate-A-Brake shows that the orbital lifetime of a CubeSat in a 700 km orbit would be reduced from ~33 years down to between 2 and 8 years depending on the launch date and solar activity. Figure 1 shows a concept of what the "brake" would look like after deployment.

The Strike-Eagle Team from ERAU also made substantial progress and had included several changes in the lightning detector as well as a complete rethinking of the communications system. Many CubeSat projects elect to modify HTs and use either AFSK/FM or FSK with the data formatted into AX.25 packets. Initially Strike-Eagle was also going to use AFSK/FM at 1200 baud. However, by looking closely at their data requirements they determined that 400 bps was adequate and switched to BPSK. Switching the modulation and data rate improved their link margin by a whopping 18.4 db. The improved efficiency allowed a



Lee McLamb, KU4OS, addresses the FUNSAT workshop at KSC (Credit: FSGC/FUNSAT).



First FUNSAT workshop in January 2005 (Credit: FSGC/FUNSAT).

reduction in transmitter power to just 50mW, which substantially improved the overall power budget. They also designed and built their own 70cm receiver and transmitter. Strike-Eagle also elected to use the P3D block format with their data being sent as K-blocks. This will allow the use of programs like AO40rcv⁶ to demodulate, decode and log their data.

UCF also demonstrated the progress they had made with sample torque coils, 3-axis attitude sensors and software to provide a real-time display the spacecraft attitude based on the sensor data. Unfortunately they missed the report submission deadline and were excluded from the final judging.

Following the presentations the Sponsors were faced with the task of choosing a winner. Ultimately the maturity and completeness of the Strike-Eagle project were the deciding factors and the team from ERAU was declared the winner.

What's Next?

Having declared the winner the FUNSAT sponsors are now funding ERAU to build the flight model of Strike-Eagle for launch on a Russian DNEPR in the Spring of 2006.

The FSGC also announced that they will be conducting another FUNSAT competition, which they expect to kick off this fall. One of the lessons learned from the competition this year is that more than one year is needed for the teams to develop their designs. As a result, the 2005 competition schedule will be adjusted to something a bit more than a year.

Additional Benefits

UF is continuing to work with AMSAT on the issue of orbital debris. Currently AMSAT has a petition for reconsideration on file with the FCC regarding their recently proposed orbital debris rules. As a follow-up to that filing AMSAT met with the FCC this Spring where the UF modeling data from the FUNSAT competition helped to reinforce our case.

ERAU is also looking at ways that they and AMSAT can continue to work together on projects in the future.

You Are Not Alone

I'd like to encourage more of our members and Area Coordinators to seek out and get involved with their local educational institutions. Many people don't because they are concerned that they "don't know enough". My experience is that many of these schools and projects need help in the areas where we as individuals are strongest, building ground stations and operating radios. If you do get stumped by a question there are many others in AMSAT quite willing to pitch in and answer a question or help out. For example, during the FUNSAT competition, many people contributed by answering my questions or helping in other ways including: Art Feller, W4ART, Rick Hambly, W2GPS, Dave Jordan, AA4KN, Roger Koss, KD4ITU, Lou McFadin, W5DID, Ray Soifer, W2RS, and Stan Wood, WA4NFY. I am very thankful for all the help they provided throughout the year. Take a look at the list of schools working on CubeSats on the Web site listed in the notes.

Is one close to you? You might just be surprised at what's being done in your own neighborhood and I think you'll also be amazed at how fun you'll have working with these energetic and motivated students.

Notes:

1. FUNSAT Design Competition, <http://fsgc.engr.ucf.edu/funsat/index.htm>
2. CubeSat Program, http://cubesat.calpoly.edu/_new/index.htm
3. Keith Chapman, Richard Conklin, Karl Daren, Ary Glantz, Gary Kelley, Kyung-Joon Kim, John Malsbury, Patrick Motsamai, Isac Mosimanewakgang, Rushi Patel, Robert Reid, Jerry Varghese, John Wenner, Jonathan Young, Kate Zbierajuski, "Strike-Eagle Student Satellite Project", May 16, 2005
4. "Laser Communications and Energy Transfer Orbiter", December 13, 2004
5. Dante Buckley, Tom Cowan, Jeffrey Crosby, Adam Darling, Mike Fisher, Greg Freeman, Chris Hollensen, Chris Macarian, Michelle Ohlson, Doug Pittard, Matt Sarisky, James VanPelt III, "Inflate-A-Brake: Engineering Model Design and Development", May 16, 2005
6. Moe Wheatley AE4JV, "AO-40 Telemetry Decoder Project", <http://www.qsl.net/ae4jy/ao40rcv.htm>. 



2005 AMSAT Field Day Results

by Bruce Paige, KK5DO, kk5do@amsat.org

This year's Field Day was no different than others since the demise of AO-40, very few submissions and very few contacts. This year, VO-52 carried most of the weight for contacts. There were a total of 42 reported contacts on VO-52, the newest of all the satellites. AO-7 and FO-29 both had 20 phone contacts. AO-51 and SO-50 had 8 and 9 contacts respectively. Rounding out the bottom were AO-27 and the ISS. Several contacts were also made in CW on AO-7 and FO-29. GO-32 was used to upload/download several messages.

All stations operated with emergency power or battery and there were no international entries or home entries. The winner with a total of 41 points was NX2Q. Operating the NX2Q station (pictured at right) were Al, NX2Q, and Pat, KC2EWA. The second place winner was the Houston QRP Club, W5MSQ. Andy, W5ACM, and other members of the Houston QRP Club made all of their satellite contacts using only 5 watts. They worked NA1SS on Sunday morning and were ready for AO-7 when it turned up in Mode A. Their 40 element X-Yagi on 70 cm and 20-element X-Yagi on 2 meters gave them a big punch when it came to cracking the pileups.

Also at right, is Clare, VE3NPC, testing his satellite antennas before the start of Field Day on Saturday. Right is the K5DX satellite antenna array. Pictured at right below is the mobile operation of Ron, W6ZQ. All of the entries for field day appear in the table below.

Group	Score
NX2Q	41
W5MSQ	35
K5AXW	18
W0WTN	8
W6ZQ	8
W0MA	7
W4NLX	7
W5IU	7
K5DX	6
NS1RA	6
VE3RC	1



The NX2Q Field Day station.



Clare, VE3NPC, checking his Field Day antennas.



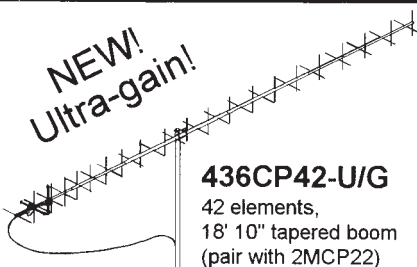
K5DX satellite antenna array for Field Day.



W6ZQ mobile satellite setup.

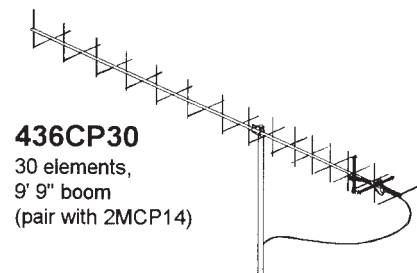
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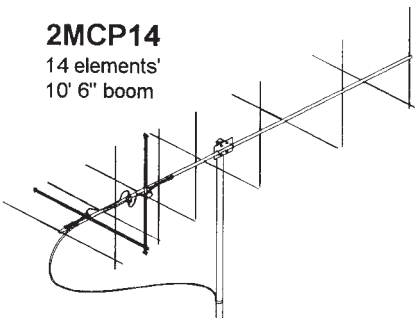
436CP42-U/G

42 elements,
18' 10" tapered boom
(pair with 2MCP22)



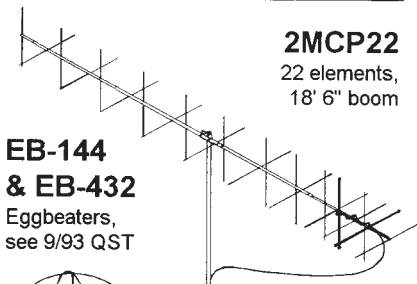
436CP30

30 elements,
9' 9" boom
(pair with 2MCP14)



2MCP14

14 elements'
10' 6" boom

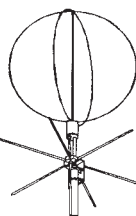


2MCP22

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2005 Small Payload Rideshare Conference

by Lee McLamb, KU4OS,
ku4os@amsat.org

One of the key challenges before AMSAT is finding an affordable means to put our satellites into orbit. In fact, partly because of our success at demonstrating the usefulness of small satellites, we now have to compete with approximately 800 other projects also looking for inexpensive or secondary payload opportunities. This is the second year that I have represented AMSAT at the National Reconnaissance Office (NRO) Small Payload Rideshare Conference since first learning of it early in 2004.

The conference was organized by the NRO Office of Space Launch (OSL) with co-sponsors of the USAF Space and Missile Systems Center/Space Test Program Office (SMC/STP), and the National Aeronautics and Space Administration/Goddard Spaceflight Center (NASA/GSFC). The 2005 conference was held June 7th and 8th at Lockheed-Martin's Launch Systems Technology Test Bed in Denver, CO. This annual conference is designed to address the issues related to access to space for small payloads, their potential benefits, and the key technologies for achieving affordable access to space.

One of the most important benefits AMSAT is getting from this conference is learning about both the people and processes that are involved in arranging launch opportunities for small satellites. One example is the Access to Space Web site¹. This is one of the primary tools being used to match payloads to spacecraft to launches. Eagle is now registered with Access to Space as a spacecraft looking for a launch and which also may have room for some experiments as well.

Several other key points were learned at the Rideshare Conference:

- Almost every US launch has had and is expected to have significant (for small sats) excess mass capability, sometimes into the thousands of kg.
- DoD/NRO are working to implement the "Surrey/ESA model" of having almost all launches carry a secondary payload adapter, although there is no schedule for this yet.

In late 2006 DoD/STP will begin flying a new secondary payload adapter which can carry up to six Eagle sized and larger spacecraft at a time.

AMSAT is the North American distributor of **SatPC32**, a tracking program designed for ham satellite applications. For Windows 95, 98, NT, ME, 2000, XP.

Version 12.2 now supports Labjack U12 and W0LMD rotor controllers and Doppler tuning for Yaesu FT-817/857/897.

Features:

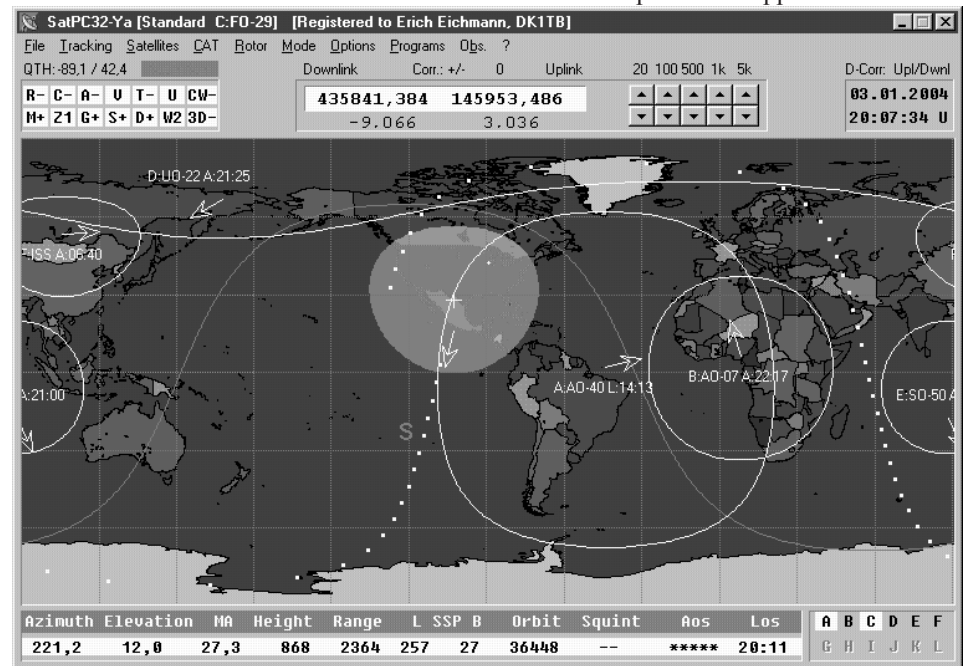
- Graphical tracking on a world map with two selectable Zoom factors.
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- Doppler tuning with on-screen frequency displays. Radio models supported: Yaesu FT-847, FT-736R, FT-817, FT-857, FT-897 ICOM IC-820H, IC-821H, IC-910H and other ICOM radios Kenwood TS-790 and TS-2000 DDE client programs
- "Transparent" VFO-knob tuning in addition to keyboard and mouse tuning.
- "Virtual" VFO tracking for half-duplex transceivers FT-817, FT-857, FT-897.
- Includes a special version for ISS split-frequency operation.
- Controls subaudible tone on FT-847, FT-736R, FT-817/857/897, and IC-910H.
- Includes a non-graphical version and programs that output lists to the screen, printer, or a file.
- Interfaces with WiSP, with user-defined satellite switching priority.

Price is \$45 for AMSAT members, \$50 for non-members, postpaid on CD-ROM.

A demo version may be downloaded from <http://www.dk1tb.de/indexeng.htm>
A registration password for the demo version is \$40 (members), \$45 (non-members).

Order by calling 1-888-322-6728, or use the online shop at www.amsat.org.

The author DK1TB donated SatPC32 to AMSAT. All proceeds support AMSAT.



Several experiments are looking for spin stabilized spacecraft and/or highly elliptical orbits. This may present a unique niche that Eagle can fill to help justify getting manifested or launch cost sharing.

More details will be presented at the AMSAT

Symposium on "Emerging Launch Opportunities for Small Satellites and Secondary Payloads" as well in future Journal articles.

Notes:

1. <http://ats.gsfc.nasa.gov/>



Why Subscribe to the "President's Club"?

So, you have joined AMSAT and are a supporter of satellites, what more should you do?

Well, let's be honest - joining AMSAT is only the first step in supporting this fascinating hobby. Joining AMSAT means that you get the benefits of being a member, such as receiving *The AMSAT Journal*. It means that you have provided funds to support the existence of AMSAT and have provided some small amount of funding for some of our smaller projects. You have helped pay the rent of our office and the salary of our one paid employee. You have contributed to the office computer and telephone and you have helped to pay the minimal expenses of the members of the Board of Directors, all of this for the cost of your membership. Yes, without adequate memberships there would not be an AMSAT, That is true of all AMSAT organizations worldwide.

You will note that I did not include any major projects in the above list of activities paid for by your membership fee, for quite a simple reason. Your membership fee no longer pays for major projects such as the building of satellites.

In the past the board of directors required that a major portion of annual dues go toward projects. This no longer is the case due to creeping inflation and the need to keep our membership dues competitive with other organizations.

To overcome this problem I started the President's Club in 2001 with the objective of collecting funds for major projects like Echo and Eagle. I am proud to say that the Presidents Club membership contributed handsomely toward ECHO, a satellite that is already exceeding our expectations.

While your board of directors and senior officers are exploring many ways of raising funds for Eagle, it must be recognized that a large amount of the funding for this project must directly come from the membership and potential users.

This is why you should support the President's Club and be a proud member of the club at an appropriate level. Yes, an appropriate level, not just a minimal level.

What is an appropriate level? That depends on a) How much you enjoy the satellite technology? b) How much you look forward

to the high orbit bird(s) c) How much you might want to work Eagle when it is in orbit d) The value of your satellite station (have you made an outlay of several thousand dollars? Are you prepared to support that outlay by supporting Eagle development?) e) What is your income? (This is none of my business, but you should take it into account.)

Let me illustrate this with my thoughts: a) I really enjoy satellite technology and enjoy listening to our experts talk about it. b) Can you imagine when we have two or three HEO birds available for operation around the world? We'll no more rely on sunspot numbers for DX. c) I will be operating Eagle every day it is available. d) My satellite station is worth over \$8K it is ready for Eagle on 2M, 70cm, 1.2GHz and 2.4Ghz any time! Yes support for Eagle is a prime requirement. e) My annual income is none of your business, but as a retired person on a fixed income and in light of the above answers (a to d) I am prepared to put in \$1200 a year at the Gold Membership level. Will you match this amount? Or maybe even exceed it?

When you donate to the President's Club you can choose the project to which you wish to send your money. These include Eagle, ARISS, P3E (AMSAT-DL) and you may even split your donation to two or more projects.

Donations may be made monthly x12 months for larger donations, however please do not request small donations (such as core) to be spread over several months.

Full details of how to make President's Club donations and the different levels with appropriate benefits may be found at www.amsat.org.

If you live (and pay taxes) in the USA, then a tax letter may be forthcoming for a donation. So in summary, support your hobby, support AMSAT projects, support the purchase of your ham equipment by joining the President's Club at an appropriate level.

73,
Robin Haighton, VE3FRH
Immediate Past President AMSAT-NA
Director President's Club

Amateurs Get 'New' FM Satellite

It was announced at the AMSAT-UK International Space Colloquium in Guildford, England by the AMSAT-UK secretary Jim Heck, G3WGM, that amateurs will be getting a new FM satellite to use.

PO-28 (POSAT-1) was launched on September 25th 1993. Its primary purpose was for commercial use on frequencies outside the amateur bands but it also has the capability to operate on the amateur bands. After prolonged negotiations it has been agreed that the satellite can be switched permanently to the amateur frequencies. It is expected that the process to change over the operation of the satellite from commercial to amateur use will take a couple of weeks.

PO-28 (POSAT-1) was built at the University of Surrey within a collaborative program in satellite technology between a consortium of Portuguese academia and Industry (LNETI, EFACEC, OGMA, MARCONI, ALCATEL, IST, UBI & CEDINTEC) and the University of Surrey, managed through Surrey Satellite Technology Ltd.

Uplinks: 145.925 and 145.975 MHz
Downlinks: 435.075 and 435.275 MHz
Orbit: 822 x 800 km, 98.6 deg inclined, sun-synchronous.

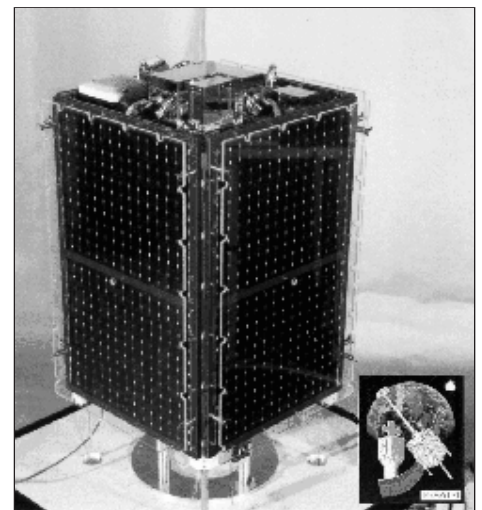
AMSAT-UK produces a newsletter packed full of amateur satellite information. For membership details contact the secretary Jim Heck, G3WGM.

Tel: 01258 453959

E-mail: g3wgm@amsat.org

Web site: <http://www.uk.amsat.org/> 

PO-28



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THANK YOU!



June 2005 Kids Day on AO-51 (AMSAT Echo)

Mike Kingery, KE4AZN, ke4azn@amsat.org

The second Kids Day for 2005 was held on 11 June. This was one week before the ARRL Kids Day due to the Mode V/S session scheduled for stations to prepare for ARRL Field Day. AO-51 was set up in High Power V/U FM repeater mode for Kids Day.

Jeff VanScyoc, KD8AJK, sent this picture (below) of Christian working AO-51 from



Christian working the satellite.

the porch. I was fortunate to work Christian on the first pass of Kids Day. He said that he is ready for us to do it again. Sounds good to me.

Here are a few messages and pictures that were sent to me from some of the participants during AO-51 Kid's Day.

Below is Adam, KB3KVD, operating his first contact over AO-51 on Kids Day. Adam is using a Kenwood TH-D7A(G) HT for the uplink and his friend Aaron is holding a small 12 volt battery. Adam's dad, Dave,



Adam and Friends making a contact on AO-51.

W2LNX, is steering the 2 meter and 70 cm Arrow antennas with one hand while tuning the downlink frequency on a Kenwood TH-D7A(G) HT with his other hand. The location was the 4-H Education Center in Front Royal, Virginia. Adam made contacts

with several other kids on AO-51.

The picture below was sent to me by Austin Michael Bruckner: "On June 11, 2005, I made my first satellite contact as part of Kid's Day. I used two portable radios; one for transmit and another for receiving. My antennas were a 3-element quad used for transmitting and a 4-element quad for receiving. They were both homemade by my grandfather, AI4GR, who helped me with the contacts. My grandmother, KI4GQZ, also assisted me. I used my grandfather's call for the contacts. The photo shows the three of us tracking Echo."

"I made two contacts, both on one satellite pass; Mike, KE4AZN, from Enterprise, Alabama, and Tom, WB4FWQ, from Knoxville, Tennessee. My location was EM



Austin and his Grandparents working AO-51.

85 in Western North Carolina. The site was surrounded by beautiful mountains but they interfered with low-angle passes, so I had to wait for a high pass."

"I am 9 years old and just finished third grade. This was an awesome experience and was much better than sitting at home watching TV. I can't wait until next year's satellite Kid's Day. Maybe by then I will have my own license."

I received a nice note and the picture to the upper right from David and Naomi in Australia. "Thanks for holding Kid's Day. My daughter Naomi had three contacts

during two passes. The first two with VK2TRF and VK2ZTY and their children were made at our home QTH. The second pass with VK5HI who was portable 20km from home just before my club's hidden transmitter event (they were going to try to find us). Equipment used was an FT-60 handheld for the uplink, FT-817 for the downlink and a homebrew Arrow antenna. I've included a picture taken after the portable QSO with Colin, VK5HI. Naomi enjoyed it so much that she was able to make another two contacts the following weekend while helping me with a portable mode V/S setup. We're both looking forward to the next Kids Day.



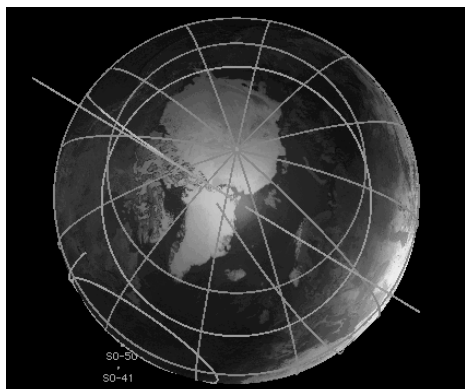
Naomi making a contact with her Father, VK5DG, on AO-51.

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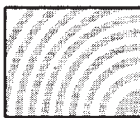
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Mode V/S on AO-51: Something New Under the Sun

Drew Glasbrenner, KO4MA, (ko4ma@amsat.org)

There is an exciting new mode available on AO-51 that is gathering lots of attention lately. Mode V/S is a new combination of a 2m FM uplink coupled with a 13cm FM downlink. This new mode has proven to be very popular on AO-51, running first on Experimenter's Wednesday, then for several week-long sessions, culminating in its use on Field Day 2005. It offers something for every type of operator. For those experienced AO-40 operators, it is an opportunity to shake out the spiders and put their Mode S equipment back to use. For the newer or less experienced AMSAT enthusiast it is a chance to get their feet wet on Mode S with a strong signal and simple equipment for both the uplink and downlink. This article will present some of the common equipment configurations that have been used, concentrating on simple setups commonly used both portable and mobile. Along the way I hope to both entice you to try V/S and to offer some hints on making it a successful venture.

The Satellite

AO-51 is perhaps best known for operating in Mode V/U FM repeat, or perhaps by some for the 9600 baud PACSAT protocol mailbox onboard. But to me the most exciting thing is the 13cm transmitter tucked away in the experiment tray. This tray contains the Motorola 2401.200 exciter with a custom controller built by Chuck, KE4NNF, the final amplifier built by Charlie, G3WDG, provided courtesy of AMSAT-UK, and the L/S diplexer built by George, K4RSV. Power output at the antenna is 2.5 watts. This tray was assembled and tested by Lou, W5DID, in the AMSAT lab in Orlando, FL before integration and launch. The uplink receiver and antenna used for V/S is the same linearly polarized whip mounted on the top of the spacecraft and used for all reception other than L band. The L/S antenna is a linear dual band design built by Stan, WA4NFY, and mounted in the middle of the bottom of the spacecraft. I'll try to address some specific questions about the hardware and configuration later in this article in the Q & A section.

Station Configurations, Big to Small

By now most of us have seen many pictures and descriptions of AO-40 class stations with

13cm receive capabilities. Often these setups include a satellite specific transceiver with a 2-3 foot diameter or larger dish, automatic az-el control and usually computer Doppler tuning. The good news is this configuration gives outstanding receive capability on mode V/S. The auto-tracking and computer Doppler tuning make reception truly easy. The bad news is that most AO-40 stations were configured to use 2m as the IF for their



Picture 1: Mode V/S mobile antennas of Mike, KE4AZN.

13cm downlink downconverter. With AO-51 mode V/S requiring a V band uplink, this is a potential problem! Luckily, the 2m band is perhaps the band for which the most of us have more than one radio. The combination of a LEO orbit and a very sensitive receiver on the satellite makes even a handheld 2m radio an effective uplink. By using your satellite transceiver for the downlink you retain all the nice automatic Doppler correction, while using a second 2m radio for the uplink doesn't require high power, and the low Doppler shift on the 2m uplink may be effectively ignored on FM. If you are reluctant to unhook your normal 2m satellite antenna to connect to the second radio, even an omni-directional antenna outside is perfectly adequate on the uplink.

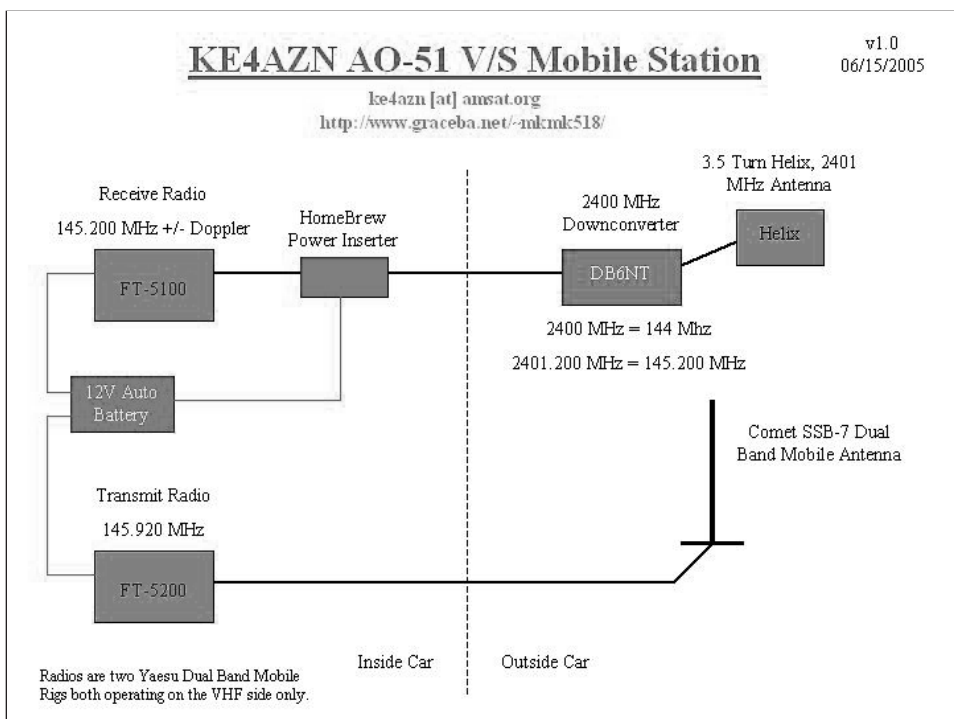
True mobile (in motion) operation is possible on V/S, but can be limited due to antenna

pointing requirements and the need to aggressively tune the rapidly changing downlink frequency. Mike, KE4AZN, has made several QSOs in this manner. Picture 1 shows the mounting of a DB6NT downconverter and helix feed on a trunk mount for the downlink. Using a pair of radios both including 2m (Picture 2), Mike is able to transmit up on his normal mobile antenna on 2m, and receives the downlink simultaneously. The broad main lobe of the receive helix can be pointed straight up for high passes, or tilted down for lower passes. Picture 3 shows a block diagram of Mike's mobile station.

Much more common is mobile operation while parked. Jerry, VE6AB, uses a configuration common to many stations (including mine), but I've not seen pictures of any mobile V/S station so complete and securely installed! (Picture 4) The downlink antenna is the stock dipole included with the Transystems downconverter as used on the BBQ dishes sold by Bob, K5GNA. The corner reflector is a new item available from Bob that simply clamps by a thumbscrew to the body of the downconverter, creating a corner reflector with somewhere in the neighborhood of 10db of gain. Following the downconverter is usually a small inline attenuator to knock down the extremely loud IF signal as well as protect the downconverter from an accidental transmission from the receive radio. There is also a small power inserter to feed the appropriate voltage up the coax to the downconverter. Uplink is from a second 2m radio connected to a roof mounted whip. The downlink antenna is simply held by hand out the window of the parked vehicle, allowing easy pointing. (Picture 5) Since both the downlink antenna on the satellite and the



Picture 2: Mode V/S mobile radio setup of Mike, KE4AZN.



Picture 3: Block diagram of mobile KE4AZN's V/S system.

receive antenna are linearly polarized, rotating the downlink antenna can give as much as a 20 db difference in received signal strength. Jerry's impressive mobile setup also can be seen to include a PDA for tracking and pass predictions, and a digital recorder to log calls. Excellent!

True portable operation is very common on V/S and, in my opinion, very exciting. A portable station can be used from a balcony for the apartment or condo dweller, from a parking lot for the employee on a lunch break or from the nearest open area for those who live where heavy foliage or steep mountainsides make operation challenging. Many people would say it's better done with 2 people, but that's not a bad thing sometimes. David, VK5DG, is operating here with his daughter (Picture 6). She's holding a dual band Yagi antenna and an FT-60 HT for the uplink, while dad points a WASVJB 5 element PC board Yagi feeding



Picture 4: Mobile radio system of Jerry, VE6AB, used for Mode V/S.

a converted MMDS downconverter and a FT-817 receiver. Note the uplink and downlink antennas are in the same plane. Both have headphones to hear the downlink, help point the antennas and prevent feedback while operating full duplex. The team approach really makes it easy!

John, KC8ZFN, has refined V/S portable to a high degree with his excellent setup



Picture 5: Jerry, VE6AB, demonstrates parked mobile V/S technique.

(Picture 7). John purchased a dual-IF downconverter from www.keps.it and integrated it with the VHF half of the Arrow antenna that so many of us have. The Keps downconverter has a little switch on the back that allows you to switch the output between 145 MHz and 435 MHz. This means that with a diplexer to separate the uplink and downlink at the radio, a single dual band HT can be used for V/S operation. Mounting the downlink patch antenna and the downconverter to the boom of the Arrow,

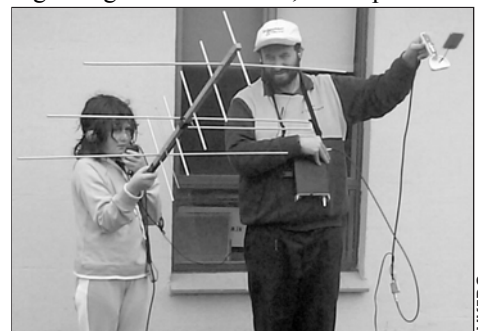
John has simplified pointing both antennas to a one-handed operation. A Kenwood HT, headphones and a small sealed lead-acid battery to power the downconverter rounds out the setup.

At the 2005 Dayton hamfest I teamed up with Mark, N8MH, and Jeff, KB2M, to provide satellite demonstrations for the attendees. During a particularly well attended demo of V/S, one of us pointed my Transystems downconverter and corner reflector and used an HT to receive the downlink. We then passed around another HT with a long rubber duck to several of the onlookers who made QSOs as the satellite passed overhead. Our uplink signal continued to be heard until the satellite was within a few degrees of the horizon. When there is cooperation and no QRM on the uplink, AO-51 is extremely easy to access with even the simplest of equipment. Picture 8 shows the group gathered just before Rick, W2GPS, makes a contact using the HT with a simple 1/4 wave whip for the uplink.

The Future

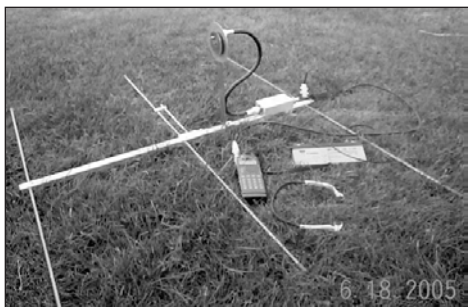
At the time I wrote this article in July, the ESA student project SSETI was being readied for launch near the end of August. This satellite contains a Mode U/S FM repeater courtesy of AMSAT-UK that should be activated a few weeks to a month after launch when the primary experiments are completed. I expect U/S operation on SSETI to be as popular as V/S on AO-51. With an antenna system consisting of 3 patches and a power output comparable to AO-51, SSETI should be an easy satellite to hear on S band. Doppler shift on the uplink will need to be accounted for however, but in five or so 5 kHz steps this should be manageable by the portable station. See AMSAT-UK's Web site for the latest information on SSETI at <http://www.uk.amsat.org/>.

Due to a large amount of positive feedback regarding V/S on AO-51, the Operations



Picture 6: David, VK5DG, and his daughter work V/S portable from Australia.





Picture 7: Portable Arrow/patch combination belonging to John, KC8ZFN.

Group intends to continue to run V/S sessions for the foreseeable future. They may be reached at ao51-modes@amsat.org. Current modes and planned changes may be found on the Control Team page at <http://www.amsat.org/amsat-new/echo/ControlTeam.php>.

Frequently Asked Questions about Mode V/S

Q: What is the Doppler shift like on the S band downlink?

A: It really moves, but is manageable. Gould, WA4SXM, has made a nice Excel graph showing the Doppler shift on a 38 degree pass (Picture 9). It shows about 110 kHz of total shift, or +/-55 kHz. Notice the majority of the change is in the center of the pass around Time of Closest Approach (TCA) and the approach and departure have relatively small changes. By tuning in 5 KHz steps you can keep up for most of the pass. If you have it available, computer controlled Doppler tuning is nice. If you are using a Icom IC-910, enable the AFC at the beginning of the pass and it will keep the signal centered for the entire time you have a signal.

Q: How do I tune the uplink for Doppler shift?

A: The uplink Doppler shift is only about +/- 3 KHz, which is well within the width of the uplink receiver. There is no need to tune the uplink. This really works out nice considering the tuning required on the downlink.

Q: Why not U/S so I can use my AO-40 station?

A: While AO-51 does have a multimode multiband receiver onboard (the SQRX), operating it on UHF has been deemed unnecessarily risky by the command team. If while listening on UHF a partial reset or other error caused one of the UHF transmitters to power on, the SQRX could be damaged. This would render all

uplinks other than 2m FM unusable. Many of the other experimental modes rely on the SQRX receiver such as the PSK modes, SSB to FM repeat mode and the L/U and L/S modes. Sounds like a good decision to me.

Q: Won't my 2m uplink interfere with my 2m IF on the downconverter?

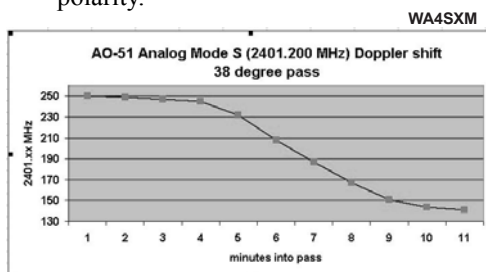
A: Probably not. Most downconverters output the downlink at about 145.2, and the uplink on V/S is normally 145.92. With good shielded coax and moderate power this is enough isolation to prevent interference. If you experience interference, separate the cables, reduce power and possibly remove any attenuation in the IF coax.



Picture 8: At Dayton 2005 Rick, W2GPS, prepares to uplink to AO-51 with an HT and whip while Drew, KO4MA, manages the downlink.

Q: What polarization is the S band downlink? Should I use RHCP or LHCP?

A: The polarization of the S band transmit antenna is linear. Either RHCP or LHCP will work as will linear antennas if you can match polarity by rotating the antenna, have enough gain to overcome polarity fades or can tolerate occasional fades. If you intend to use the antenna on future S band downlinks like P3E or Eagle, you should use RHCP. A dish will invert the polarity of a feed so use LHCP for a dish feed to obtain a RHCP antenna polarity.



Picture 9: Graphical representation of Doppler shift on a typical AO-51 pass in mode V/S.

Q: What is the popping sound I sometimes hear?

A: We share 2.4 GHz with lots of consumer electronics many of which use spread spectrum techniques, including cordless phones and Wi-Fi computer equipment. These sound like rapid pops or pulses on analog receivers. Additionally, there are analog cordless phones, baby monitors and A/V links operating in the band. Microwave ovens are also a source of considerable wideband noise.

Q: Why should I only operate full duplex?

A: A single channel FM repeater 800km high can attract lots of users! If more than one user attempts to transmit at the same time the resulting collision can prevent anyone from being heard. Therefore, by operating full duplex you can hear if there is a problem when transmitting, preventing the useless blocking of the satellite. The same situation applies to transmitting before you can hear the downlink; just don't do it and you will not interrupt ongoing communications. Wait until you can pick out a station and make a short quick call like this, "N8MH from KO4MA EL88, over." Also, remember to use your headphones to prevent painful feedback squeals!

Q: Can we run V/S and V/U at the same time?

A: Unfortunately not. The S transmitter can not operate at the same time as either U transmitter. Additionally, while the PL tone can be used to switch the U transmitters on and off, it can only be used to gate the audio on the S transmitter. The S transmitter runs continuously when it is configured in V/S.

Q: Can I use a scanner with my downconverter instead of a 2m amateur radio?

A: Absolutely! Since you are only receiving with that radio, a scanner that can tune in 5 kHz steps is just perfect, and as a bonus there is no chance of damaging your downconverter by transmitting into it accidentally.

Wrap-up

Good Luck on V/S and see you on the air soon! 📶



Satellite Tracking Programs

Gould Smith, WA4SXM, wa4sxm@amsat.org

At the heart of amateur satellite operation is a tracking program. I have used 18+ different tracking programs over the years, and this is just the tip of the iceberg of what is available. All the programs I have used provide two critical pieces of data: 1) when the satellite is visible at my location; 2) where the satellite is in the sky at a particular time. How this data is presented and additional features are the programmer's choice. The user must determine what features are important and select one or more tracking programs to fulfill this need. AMSAT offers an excellent array of programs to track amateur satellites and the authors have donated all or part of the proceeds to AMSAT to further the amateur satellite cause. I haven't found one program that met all my needs, so I routinely use four different programs, depending upon what I need to do.

We will look at some of the tracking programs and their features in this and other columns. In addition to the two primary functions we will look at a number of auxiliary features of these programs. I have chosen not to just show a comparison chart because those new to satellite operation and tracking programs may not have a good understanding of what these features are and which ones they will find the most useful. The features I have chosen to discuss and later compare are:

Setup:

QTH
Radio
Satellites

Display:

Satellite Selection
Single/Multiple Satellites
AOS/LOS
Satellite Direction
Multiple Views
Zoom in/out
3D/Flat Display
Sun Line
Satellite Eclipse
Ground Track
Doppler Display
MA
Mode Change
Sub-satellite Point
Squint Angle
UTC/Local Time
Text Display

Operation:

Produce a schedule
Preview Mode
Fast Forward/Reverse
Groups
Sound Announcements
Keps Update
Help

Control:

CAT control
Rotor control
DDE

to user requests, satellite modes and new hardware.

This is well designed and very functional tracking program. If you have the multiple satellites function enabled you instantly see the location of each satellite, which direction it is moving and the next AOS time for your QTH. But wait, there is more!

Setup

After installation, you must SETUP your tracking program, this means – your QTH, radio control (if needed), satellites and new Keps. The QTH setup is very straight forward. Run SatSetup under Programs in the toolbar; enter your gridsquare, longitude, latitude and UTC offset. SatPC32 supports frequency correction for most new satellite desktop radios and rotor control for many rotor controllers. If these use a COM port or hardware port, set these up in the SatSetup window also.

Next select the Satellites item on the Toolbar to choose which satellites to display. Double click on the satellite in the Available window to copy it to the Selected window. Don't forget to click on Display On/Off to get it to show. A '*' will appear next to the satellite name if selected to display. Enter a current Kep file and you are good to go. See Figure 2.

Display

SatPC32 allows twelve satellites (A – L) in each group. The group, satellite letter and the name of the selected satellite are found in the title bar of the program (ISS in Figure 1). The selected satellite has a filled-in footprint in the display area. You change the selected satellite by clicking on a letter in the lower right hand corner. Satellites in view will have a highlight behind them; gray ones have not been configured, see Figure 4.

The user can easily switch between single and multiple satellites by clicking on the M (multiple) icon in the control block, found in the top left of the screen. This control box is a very powerful feature of the SatPC32 program and gives the user quick control of the display and auxiliary features.

The next AOS/LOS (Acquisition of Signal/Loss of Signal) for the selected satellite at your QTH is found in the text display along the bottom of the window. The AOS time is

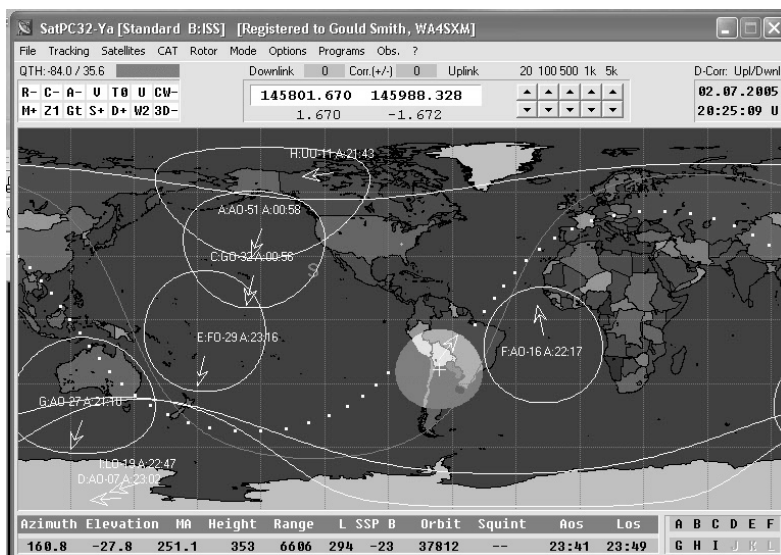


Figure 1: SatPC32 screen display.

SatPC32

This column will focus on the SatPC32 program by Erich Eichmann, DK1TB. The current version in early July 2005 is v12.3. Once you register the program with AMSAT you can get free updates from Erich's Web site <http://www.dk1tb.de.SatPC32> continues to evolve in response



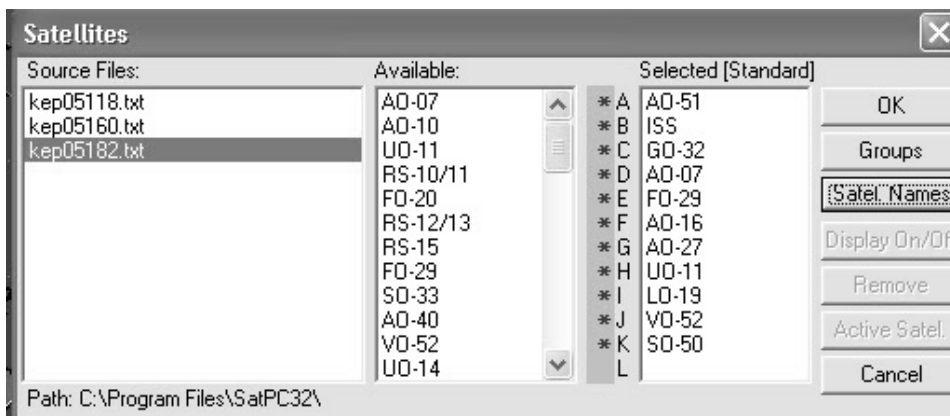


Figure 2: SatPC32 satellite selection screen.

also found inside the footprint of the satellite in the graphical window along with a direction arrow. This arrow is a very helpful feature and one of my favorites in the program.

Views

SatPC32 allows you to select the size of the display window for the program (640x480, 800x600 and 1024x768) in the Options selection from the toolbar, see Figure 3. Here you can also configure which features you want activated when the program starts. You have a choice of centering the map on the longitude of your QTH, Greenwich, England or Observer 2.

There is a ZOOM factor in the control box in the upper left that switches between the standard Z1 full map and Z2 zoomed in view around the selected satellite footprint, see Figure 4. There is also an automatic satellite select in the Options window and in the control box, which will switch to any satellite that is currently visible to your QTH. This is handy if you are using SatPC32 to control your radio while away from the shack to collect digital data or just working consecutive passes. Before switching will occur, satellite priority for up to nine satellites must be configured in the PRIOR.SQF file.

There is a 3D display in addition to the flat map. These displays can be switched via the control box in the upper left, see Figure 5. The sun line separates which areas of the earth are illuminated by the sun and which are in the dark. This feature is available in the flat, zoom and 3D maps. The yellow sinusoidal line with the S in the center is the illuminated area; see Figures 1, 4 & 5. Just because your QTH may be in sunlight doesn't mean that the satellite is in sunlight, or vice versa. If you want to visually observe a satellite, your QTH needs to be dark and

the satellite in sunlight. These conditions happen shortly after sunset and before sunrise. Some satellites like AO-7 only work when in sunlight. SatPC32 tells you the current sunlight status for the selected

ground track can be turned On/Off using the G item in the Control Box. There are three states: Off (G-), temporary display (Gt) and constant display (G+), see Figures 1 & 4. The ground track display constantly changes. It begins at the current location and goes for one revolution.

It is very important to know the Doppler shift of the signal to and from the satellite. The Doppler shift is different for each QTH and changes with the frequency and speed of the satellite relative to the observer. Probably the best feature of SatPC32 is the accuracy of the Doppler corrected Uplink/Downlink frequency pair displayed in top center of the display. Both the frequency and the amount of offset are shown. This is especially helpful on the transponder satellites that will allow you to instantly find yourself. You may need

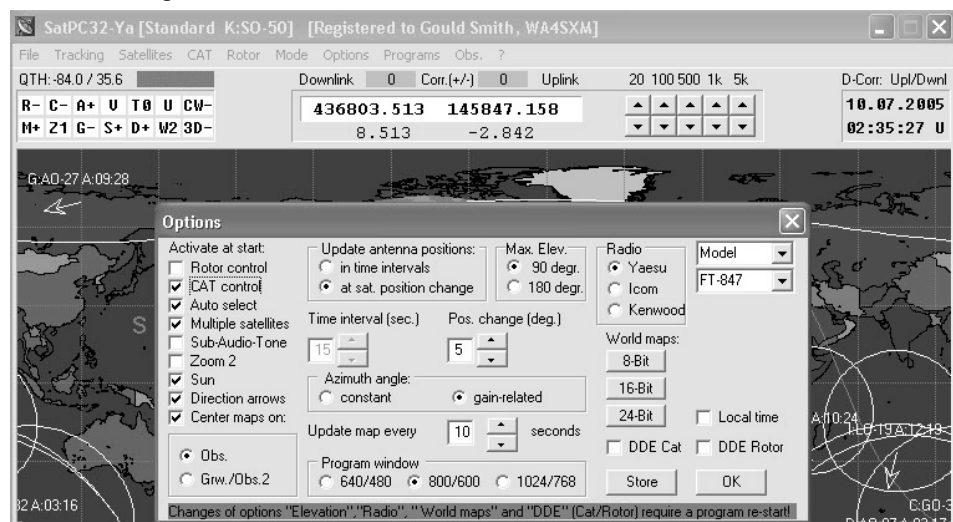


Figure 3: SatPC32 options sections.

satellite right above the control box in the upper left. The satellite is eclipsed or Sat in Sun, see Figures 4 & 5. This feature can be turned On/Off using the S icon in the Control Box.

The ground track of a satellite is the path that the satellite follows on the surface of the earth, the trail of the center of the footprint. SatPC32 shows you this path for one orbit, with the dots displayed at 2 minute intervals. The

to tweak these values to get your voice to sound very natural. This is done using the CAT item on the tool bar, see Figure 6.

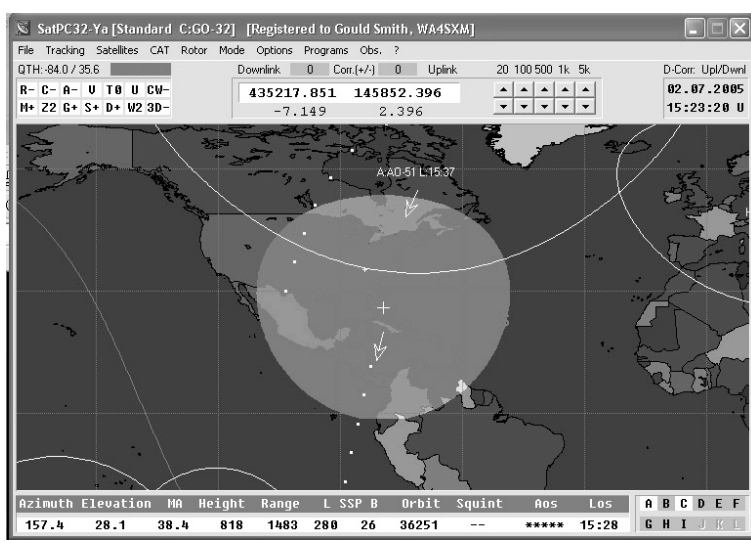


Figure 4: SatPC32 Zoom (Z2) centered on the satellite footprint.



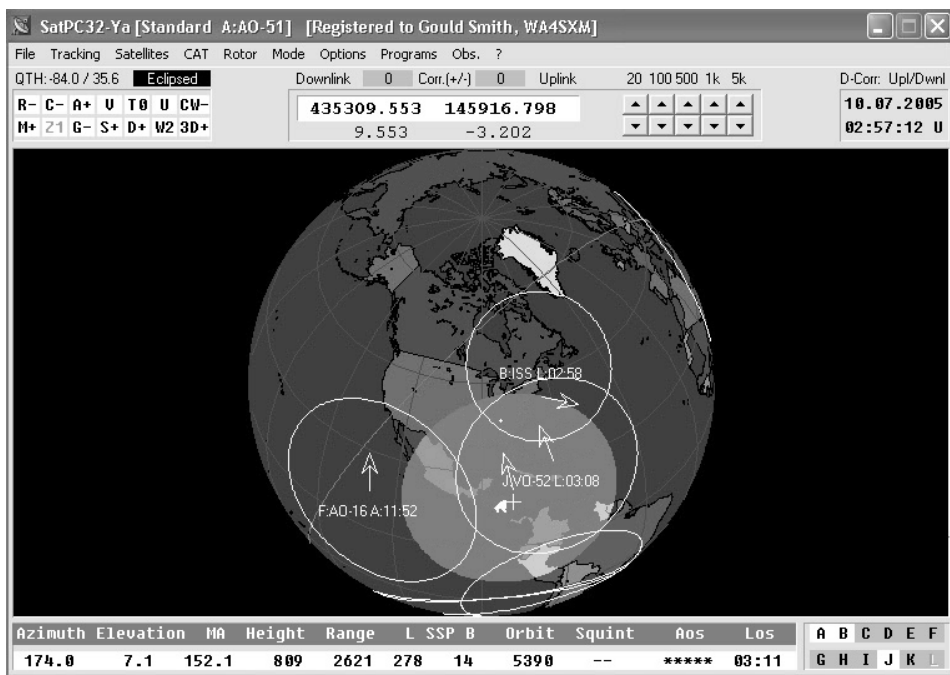


Figure 5: SatPC32 3D display.

Complete instructions are in the Help file. When you set it up for each satellite and store these values you will be on frequency from then on, or in other words “You can set it and forget it”. Many of the amateur satellites have multiple modes so you will need to switch between these to get the correct frequency and Doppler correction. This is done in the CAT window also. Simply click on an alternate frequency mode pair in the Select Frequency box and the new frequencies are Doppler corrected. If you need to add new modes or satellites, these are done in the DOPPLER.SQF file.

UTC (Universal/Greenwich time) is the de facto standard for tracking programs. If you must have the information in local time, the display can easily be switched using the U/L item in the Control Box. The current time is displayed in a box on the top right, bottom

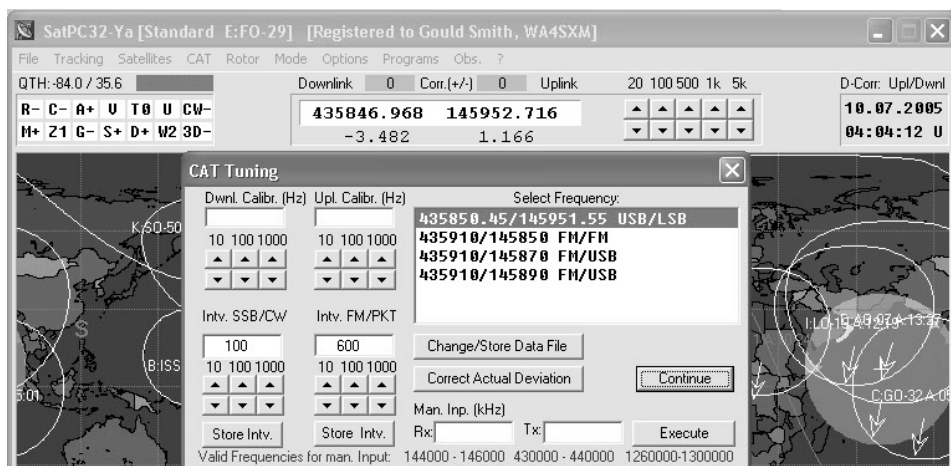


Figure 6: CAT tuning adjustment.

line with a U for UTC or L for Local after it. Check your computer clock against a known source and keep it within seconds, especially if you are doing automatic frequency/rotor control.

The date is given in European/Military format DD.MM.YYYY, the figures in this article are from the 2nd and the 10th of July, not February/October 7th.

Text Display

The text display at the bottom of the screen gives the relevant data about tracking the satellite Azimuth, Elevation, AOS and LOS. Azimuth gives you the horizontal component of the satellite position and the Elevation gives you the vertical component. AOS/LOS tells you when it is over your location.

MA (Mean Anomaly) tells you where the satellite is in its orbit. The orbit is divided into 256 equal time periods (this is an 8 bit digital thing). Zero is at perigee (closest to earth), the MA values increase to MA 127 at apogee (farthest point from earth) and continue to increase as the satellite returns back toward earth, MA 255 is just before perigee. This value is useful to know because

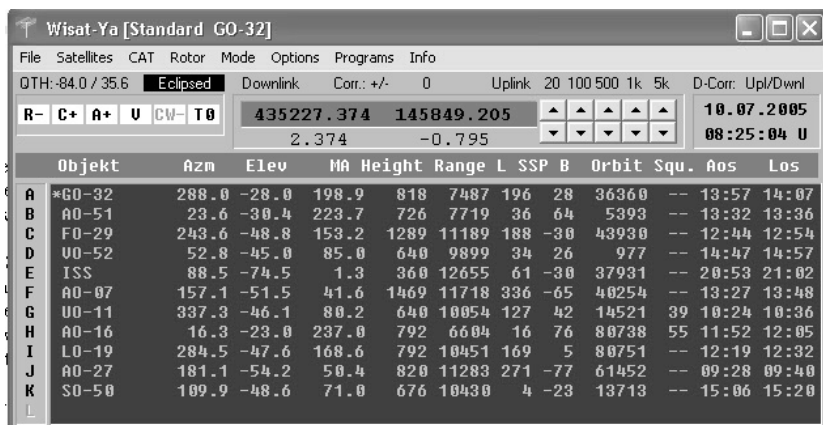


Figure 7: The text only version of SatPC32 called Wisat32.

some amateur satellites change mode at specific MA points in their orbit. SatPC32 has no mode change function at this time, but Erich has indicated that he can add it if it becomes needed. Many programs allow you to input a string of three numbers for the MA followed by one or two characters for the mode. Then as the satellite reaches this MA, the program will display that mode until the next MA value in the string when it will display the new mode. This feature will be useful when the HEO satellites once again return to orbit.

The SSP data is the Sub Satellite Point longitude and latitude. The point where a line drawn from the satellite to the center of the earth intersects the surface, this is used for footprint center and ground track.

The Squint angle value is another useful



Day	Time (U)	Azm	Elev	MA	Height	Range	Lon/Lat	Orbit	Squint
10.07.2005	13:33:00	79	1	244.3	705	3031	307 37	5396	-
10.07.2005	13:35:00	96	1	249.4	702	3063	305 29	5396	-
10.07.2005	15:07:00	20	2	229.0	720	2923	291 58	5397	-
10.07.2005	15:09:00	25	11	234.1	714	2135	288 51	5397	-
10.07.2005	15:11:00	38	25	239.2	709	1410	285 44	5397	-
10.07.2005	15:13:00	80	46	244.3	705	941	282 37	5397	-
10.07.2005	15:15:00	148	35	249.5	702	1128	281 29	5397	-
10.07.2005	15:17:00	169	16	254.6	700	1773	279 22	5397	-
10.07.2005	15:19:00	177	5	3.7	700	2544	277 15	5398	-
10.07.2005	16:47:00	347	3	229.1	720	2791	266 58	5398	-
10.07.2005	16:49:00	332	10	234.2	714	2212	263 51	5398	-
10.07.2005	16:51:00	308	15	239.3	709	1861	260 44	5398	-
10.07.2005	16:53:00	279	14	244.4	705	1877	258 37	5398	-
10.07.2005	16:55:00	255	9	249.5	702	2251	256 30	5398	-
10.07.2005	16:57:00	241	2	254.7	700	2841	254 22	5398	-

[C] DK1TB 2004 QTH: -84.0 / 35.9 10.07.2005 07:23:58 U

Figure 8: Sample SatPC32 WinListen display.

feature for HEO satellites with directional antennas. It is the angle that the satellite antennas make with your QTH. Obviously the smaller this angle the better. The values used to compute this angle change with satellite orientation and will be available from the satellite or the AMSAT BB. These values must be entered into the SQUINT.SQF file manually.

There is another program included with SatPC32 that performs most of the same functions as SatPC32 except it has no graphical display. It is a standalone program called Wisat32. It gives you all the information shown on the bottom and top of the SatPC32 screens for all the selected satellites. If you just want the basic tracking information and CAT/Rotor control this is a good alternative, see Figure 7.

OPERATION

It is often important to print out a schedule of when satellites will be available to plan your operating or demonstration schedule. There actually are two types of schedules, a general schedule and a specific track. The general schedule can tell you when multiple satellites or a specific satellite will be in view for any date range; plus you get the maximum elevation and the beginning and ending azimuth for each pass. The specific schedule gives you a list of the azimuth and elevation every minute or so during the time a specific satellite is in view. The specific schedule is the best one to start with. Once you get familiar with satellite tracking you

will be able to take the general schedule and track the satellites well. SatPC32 provides these schedules through standalone programs.

WinListen is the specific scheduling program. Here you get satellite tracking information in two-minute increments to allow you to schedule and to track the satellite during the entire pass. It can be run either from your desktop or by selecting it from the SatPC32 dropdown box under PROGRAMS in the toolbar. The specific tracking data for a selected satellite can be displayed on your screen or printed for up

to 10 days, see Figure 8.

WinAOS gives you a general schedule for multiple satellites. It also can be run from your desktop or from the PROGRAMS item on the toolbar. It will give you the basic information to plan your operations and track the satellites, after some practice. See Figure 9. The Period is the length of time that the pass lasts.

In addition to being able to look at a schedule, it is often good to be able to visualize the satellites and their position with respect to one another. To do this, use the Preview mode under Tracking in the toolbar. Select Preview and you will get Forward and Backward arrows in the Control Box. Click on them to move the satellites forward or back in time. If you click on the F- key next to the Forward arrow they will move 5x as fast per click. To return to the current status, select Realtime under the Tracking item in the toolbar.

Satellites can be grouped in SatPC32 to allow you to organize them. This is done under the Satellites item in the tool bar, see Figure 2. The groups are generally organized as analog satellites, digital satellites, all satellites, etc.

SatPC32 currently doesn't have any voice announcements. Some tracking programs will play WAV files for events like satellite rising, setting, etc.

Keys Update

Keys updating for SatPC32 is manual. On

Date	Objects(009)	AOS (U)	LOS	Period	maxEl	AZ
10.07.2005	AO-16	11:52	12:05	13	18	034 - 159
10.07.2005	LO-19	12:19	12:31	12	15	037 - 151
10.07.2005	FO-29	12:44	12:54	10	06	051 - 135
10.07.2005	AO-07	13:27	13:47	20	34	028 - 171
10.07.2005	AO-16	13:31	13:45	14	43	003 - 210
10.07.2005	GO-32	13:57	14:06	09	07	052 - 132
10.07.2005	LO-19	13:58	14:12	14	53	005 - 206
10.07.2005	FO-29	14:27	14:43	16	76	013 - 193
10.07.2005	VO-52	14:47	14:56	09	07	047 - 138
10.07.2005	AO-51	15:06	15:20	14	48	019 - 181
10.07.2005	SO-50	15:07	15:19	12	21	169 - 046
10.07.2005	AO-16	15:13	15:19	06	03	327 - 273
10.07.2005	AO-07	15:19	15:40	21	48	010 - 218
10.07.2005	GO-32	15:35	15:50	15	74	014 - 192

[C] DK1TB 2004 QTH: -84.0 / 35.9 10.07.2005 07

Figure 9: SatPC32 WinAOS display.

the top tool bar, choose File, Open then select the new Kep file. Each time you open SatPC32 it will get the Keplerian data from the last selected file. If you name your updated Kep file the same name each time and place it in the same directory you won't need to go through this procedure each time. The Source file list in Figure 2 is where you select the file to be used. This file must be selected in SatPC32, WinListen, WinOS and WiSat32 independently. Always check the output data against a known source to make sure that you are getting correct tracking data. It is a common mistake to use the wrong Kep file. You think you selected a file, but you didn't and the program uses another Kep file.

Some tracking programs can be configured to automatically connect to a Web site (if the computer is connected to an ISP), download new Keplerian elements and update them in the program – all in the background. Other than the ISS which needs almost daily Kep updates, you only need to update your Keps about every three weeks or so. This involves going to the a site like amsat.org, go to the Keplerian data area, copy the data into a text editor like Notepad, then save the file to your desktop or into the tracking program directory. Then you must use the particular update procedure for that software. I recommend that everyone become familiar with manually updating their Keps. Automation is great, but you need to be able to do it manually and quickly sometimes.

Erich is working on an update to the program (available late fall 2005) that will allow you to use the TLE Retriever by Dr. T.S. Kelso, or HalloKepler by Gerd Riesner, DB3DH. These programs are free and allow the user to automatically login to the SpaceTrack or Celestrak website and download the Kep files. To use the SpaceTrack system you must get a login account. Also for those users of SpaceTrack, the utility will automatically convert the SpaceTrack name to the AMSAT name. Kep updates will just be a matter of starting one of the retriever programs and click two buttons.

Help – There is an excellent onscreen HELP with SatPC32. As with all tracking programs it behooves the user to take the time to read the help file in order to get the most out of the tracking program.

CONTROL:

CAT or Radio Control

SatPC32 can control these radios; some have more control functionality than others.

Yaesu: FT-736R, FT-847, FT-817, FT-857, FT-897

ICOM: IC-820H, IC-821H, IC-910H and others

Kenwood: TS-790, TS-2000

To enable this feature select your radio from the drop down list under Options in the toolbar, see Figure 3. Match the baud rate and com port between the computer and radio. Then click on the C item in the Control box to toggle the radio control On/Off. Be sure and read the SatPC32 Help file for specific information about controlling your radio. They all behave a little differently.

Rotor Control

SatPC32 can control these hardware rotor controllers: AlfaSpid rotor and G6LVB Tracker which are Yaesu GS-232 compatible, EGIS rotors, RIF-PC rotor interface (Orbitronics), Winrotor parallel port and USB interfaces (Funkbox), ARS (EA4TX), Kansas City Tracker/Tuner, Yaesu GS-232-rotor interface and compatibles (DL7AOT interface, CX6DD interface and the French SatDrive interface), HalloRotor interface (DB3DH), FODTrack rotor interface (AMSAT-CE), SatEl rotor interface (Satellite Electronics), SAEBRTrackBox (N8MH), Labjack U12/PiggyBack (NLSA) combination and W0LMD Tracker (Mini, Junior, Senior). Again, be sure and read the Help file for additional information about controlling these devices. Erich is working on an update that should be available around October that will allow you to simply select the rotor interface/controller from a list.

An alternative to direct control of devices is to use DDE (Dynamic Data Exchange). Here the SatPC32 program can provide current, generic information (azimuth, elevation, uplink, downlink and MA) to a shared data area on your computer. Third party software can reference this data and enable third party hardware that can control radios and rotors.

Special Features

Each of the tracking programs has special features that are either not common to most of the other programs or do an exceptional job. The spot on Doppler calculations, easy control of the display, CAT and Rotor control, as well as the direction arrows are standouts for SatPC32.

Summary

All the AMSAT tracking software applications are good programs and will give

you the necessary information to work the satellites. The decision for you is what features you need to make it a better experience. Most of these programs have a demo mode, which allows you to download the software and use it to see if it meets your needs. Generally you have to enter your QTH information each time you run the program. Now that we have established a common understanding and set of criteria to evaluate these tracking programs, we can continue by looking at other AMSAT tracking programs. I will list their features following the list at the beginning of future articles. This should allow you to make a more informed choice. 🌐



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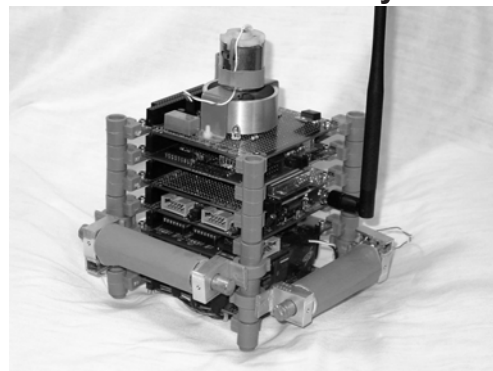
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AMSAT Eagle Update

James A. Sanford, PE
Eagle Project Manager
WB4GCS, wb4gcs@amsat.org

for the first-hand evaluation of Surrey.

Bob McGwire, N4HY, has been a busy little beaver. In addition to the above work, he has been heavily involved in getting test code running on IHU-3 in preparation for radiation testing.

Bob, Lyle Johnson, KK7B, and Chuck Green, N0ADI, worked the IHU-3 test code and also worked on interfacing a CAN module for testing. This sets us up for testing all of the important modes in the forthcoming radiation test. This group, with assistance from Frank Brickle, AB2KT, also made some progress on getting IPS running.

As an aside, IPS is an interesting language. It has a long history of good service in amateur satellites and is elegant I think. There is a great book available on IPS and some good information about IPS on the AMSAT Web site. Check it out.

In addition to all that work, Bob, Rick and Tom have done some testing of the Hittite 5 GHz modules we are considering using for C-C Rider. These things are small and produce about 1 watt at C-band. We learned a lot, especially in terms of how to operate these gems efficiently. I won't call characterization complete, but we know more than we did when we first considered these devices. We still need to assess total



power and heat transfer budgets. There will be more information on this work at the AMSAT Symposium, another reason to BE THERE.

Bob has also been involved in testing communications between the CAN modules and other things.

So, to review the bidding, things going on:

- C-band module testing
- SDX testing
- IHU-3 testing
- CAN testing

Good things are happening and remember, this IS rocket science. Or as I like to call it, "bleeding edge" technology – the challenge is the fun. Why do I call it "bleeding"? Just ask Bob, Rick, Tom, Frank, Lyle and Chuck how much blood, sweat and tears they've already shed.

Make your plans for the AMSAT Symposium. Hope to see you there.

As always, comments and questions to: wb4gcs@amsat.org ☎

Our Vision is to deploy high earth orbit satellite systems that offer daily coverage by 2009 and continuous coverage by 2012...

Here's the latest on Eagle. Coding and testing of the Software Defined Radio (SDR) package continues. Bob McGwier, N4HY, Rick Hambly, W2GPS, and Tom Clark, W3IWI, have been making some great progress developing and testing prototype transponders (that is hardware AND software) in Rick's lab. See the pictures on the report that Bob posted to the AMSAT-bb a few weeks ago. In the not too distant future it may very well be possible for all of us to participate in SDX (software defined transponder) testing via the Internet. Some exciting progress has been made on the Software Defined Radio. Look for a review in a forthcoming issue of QST.

Rick just returned from a visit to Surrey in conjunction with the AMSAT-UK Symposium (lucky dog!). He reports some great contacts and information and that he saw an SDX very similar to what we're working on. It really does work! Join us at the AMSAT Symposium in LA this fall to see our prototypes. See Rick's Apogee View

Field Day Fun in Canada

I was so excited to make my first FD satellite contact on AO-51, V/S mode. Having had only limited experience on this mode, with only 4 contacts the previous night, it was a real challenge for me.

On Saturday the 25th at 18:15 UTC, I tried to make a contact with a FD station, but unfortunately the pass was so crowded that many stations stepped over me. I only managed to make a contact with AI7W from this pileup though I copied 6 more stations. On Sunday 26th at 15:57 UTC, I made my first FD satellite contact on behalf of our club station VE4BB-3A-MB. That contact was with VE3RC (Ottawa Amateur Radio Club). This single contact made my day on FD!!! I almost had K8DAC but was interrupted by another station. I copied 10 more stations on this pass.

As a portable station, using 2 Icom IC-W32A

HT's, an Arrow antenna, our homebrew 4 turn Helix and the AIDC 3731 down-converter, we successfully managed to make this contact. I had to log callsigns, control Doppler tuning and press the PTT on transmit while listening to the downlink through headphones. My Dad was steering antennas with the Helix/downconverter in his left hand and Arrow in right hand also listening to the bird through headphones. I have programmed the receiving HT for Doppler from 145.260 MHz to 145.140 MHz in 5 KHz steps (25 steps). Doppler controlling was just a matter of turning the knob on receiving HT for best signal but was challenging. All these kept our 4 hands fully occupied. My 6 year old brother Supun also had his first FD excitement on a satellite listening to AO-51 through headphones. Although it was just one FD contact it's an unforgettable experience!!!

73,
Aruni Perera
VE4WMK - EN19 ☎



Aruni, seated and mostly out of sight, operates Field Day while interested onlookers watch and her dad aims the antenna.



A Modern Low Noise Preamp for 435 MHz

by David Bowman, G0MRF, g0mrf@aol.com

While 2 meters remains crowded and S-band is filling up rapidly with wireless LANs, Bluetooth as well as the ever-present microwave ovens, 435 MHz or U band, has remained a haven for QRM free satellite reception. However, to get the best signal into your radio, especially with simple antennas, a high performance preamp is a 'must have' accessory.

The preamp described here uses a state of the art ATF54143 PHEMT from Agilent Technologies. It has a gain of 20dB and a noise figure of 0.48dB. Better still, it has no adjustable trimmers. You just solder the components in and switch it on.

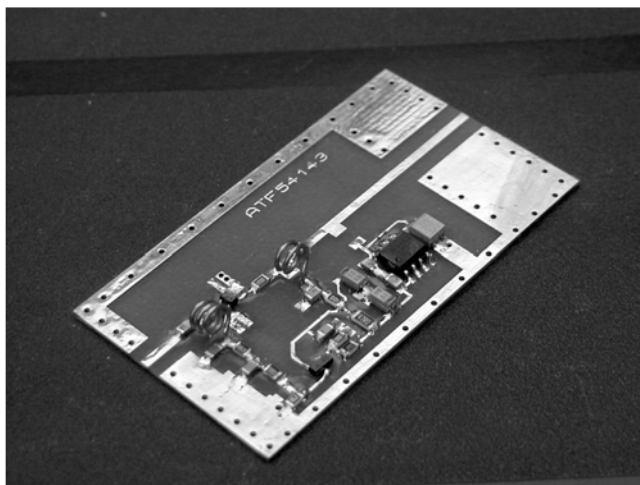
How Does a Preamp Help?

When receiving signals on 70 cm, the critical part of your system is the coax loss between the antenna and the radio. This loss in dB is added directly to the noise figure of the radio and can quickly reduce usable signals down to the level of background noise. To get the best results we need to reduce the overall 'system noise figure' to the lowest practical value. And a preamp, either at the radio or at the feed point of the antenna, can bring dramatic improvements.

In the Shack or at the Masthead?

Although not often quoted, the noise figure of a modern 70 cm radio is between 2.5 and 5dB. A typical run of 15 m of RG213 between the antenna and your radio will add another 2.2dB, reducing your system noise figure to something between 4.7 and 6.5dB. With simple antennas, this combination will give poor results. However, there are two solutions.

Figure 1: The completed pre-amp without inductor for coax power feed.



- 1) Add a preamp between the feeder and your radio
- 2) Add a masthead preamp between the antenna and the feeder.

Using the free AppCAD software from Agilent (1) it is possible to calculate the overall improvement in performance for any combination of preamp/cable type/cable length and radio. Taking the example above we can calculate and compare the system noise figures.

No Preamp:

Feeder loss 2.2dB + Radio noise figure 3dB = 5.2dB

Preamp at Radio:

Feeder loss 2.2dB + Preamp 0.48dB NF + 20dB gain + radio 3dB NF = 2.52dB

Preamp at Masthead:

Preamp 0.48dB NF + 20dB gain. + Feeder loss 2.2dB + radio 3dB. NF = 0.54dB

As you can see, the lowest system noise figure is achieved when the preamp is placed at the antenna, but even when placed at the radio, there is still a useful improvement.

Circuit Description

The ATF54143 is an enhancement mode FET and requires a small positive voltage on the gate to bias it for correct operation. To ensure that the circuit is reproducible, a PNP transistor is used for active biasing. This method compensates for any slight variations in the FET characteristics and for changes with temperature. For this amplifier the drain voltage is set to 3V and the drain current to 30mA.

The active biasing circuit works as follows:

The drain voltage is set by resistors R6 and R7. This potential divider across the 5V supply sets the base voltage of TR2. Being a PNP device, the emitter voltage is 0.7V higher than the base. The emitter voltage feeds the drain via two 10 ohm resistors, R4 and the damping resistor R8. At 30mA Id there will be 300mV drop across each of these resistors and so the emitter voltage required is 3.60V.

The drain current is set by

the value of R5. The voltage across R5 is 5V less the emitter voltage of 3.60V.

Impedance matching the FET is achieved by C1 and L1 on the input and by L4 and C8 on the output. The ATF54143 is a microwave device and it has very high gain at low frequencies. To ensure stability, the impedance matching networks also act as high pass filters giving a broad match from 350MHz to beyond 1500 MHz. At 145 MHz the amplifier has a loss of 16dB. Exactly the response needed for mode V/U satellites like AO-51. Another technique frequently used to enhance stability is to add a small amount of inductance in each of the source leads of the FET. The PCB has been manufactured with grounded tracks adjacent to the source connections. The original idea was that the source lead could be shorted to ground at just the right point to give lowest noise and best stability. However, several hours of testing showed that at 435 MHz no significant inductance was required and that a direct connection from source to ground gave the best results (2). I suspect that if the board were adapted for use at 2 m, then the source inductance would be required.

The circuit (Figure 2) is constructed using surface mount components on a double sided 31mil thick FR4 PCB (Figure 1). This material has good performance at higher frequencies and the board has nearly 80 plated through holes to ensure adequate grounding. See Figures 3 and 4 for circuit performance.

References:

- 1) Agilent technologies AppCAD software can be downloaded from www.agilent.com
 - 2) Further details are available at www.g0mrf.freemove.co.uk/432LNA.htm
- PCBs or a kit of parts are available from the author (2) or e-mail g0mrf@aol.com.

Parts List

Semiconductors:

TR1 ATF54143
TR2 2N3906SMD
IC1 78L05ACM

Resistors: 0805 unless stated.

R1 47Ω
R2 5.6KΩ
R3 1kΩ
R4 10Ω
R5 47Ω (1206) - (1206 is chip size)

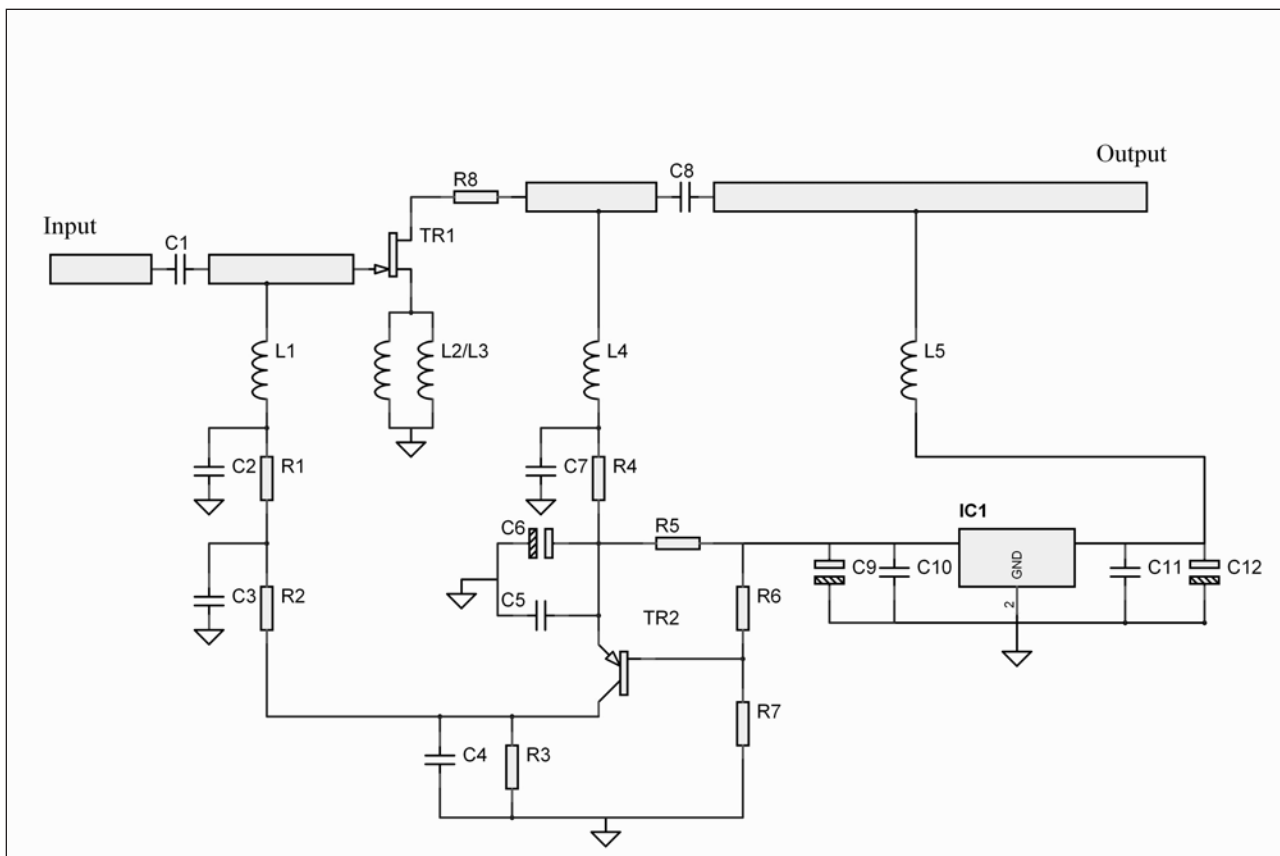


Figure 2: LNA schematic.

R6 3.9K Ω
 R7 5.6K Ω
 R8 10 Ω

Capacitors

C1 10 pF
 C2 68 pF
 C3 1 nF
 C4 10 nF
 C5 1 nF
 C6 10 μ F 6.3V tant
 C7 27 pF
 C8 10 pF
 C9 10 μ F 6.3V tant
 C10 10 nF
 C11 10 nF
 C12 4.7 μ F 20V tant

Inductors

L1 3 turns 0.56mm enameled copper, 2.7mm (7/64) ID close spaced.
 L2, L3 Printed on PCB. Short to ground at source lead for 70cms.
 L4 2 turns 0.56mm enameled copper, 2.7mm (7/64) ID close spaced.
 L5 270nH SMD inductor. Only needed if powered via coax.

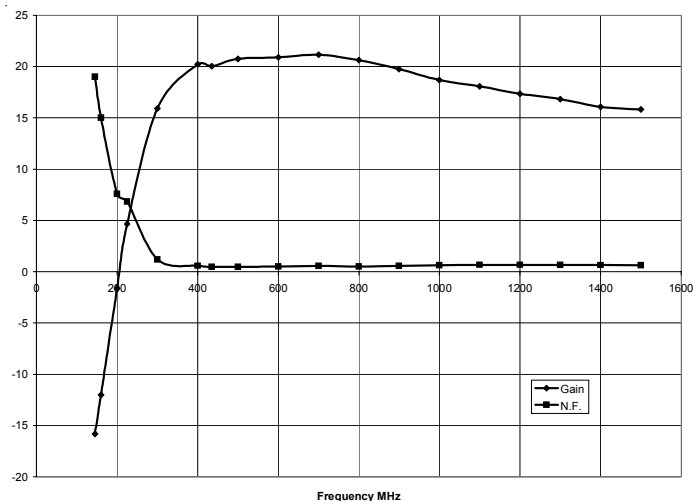


Figure 3: Gain and Noise Figure.

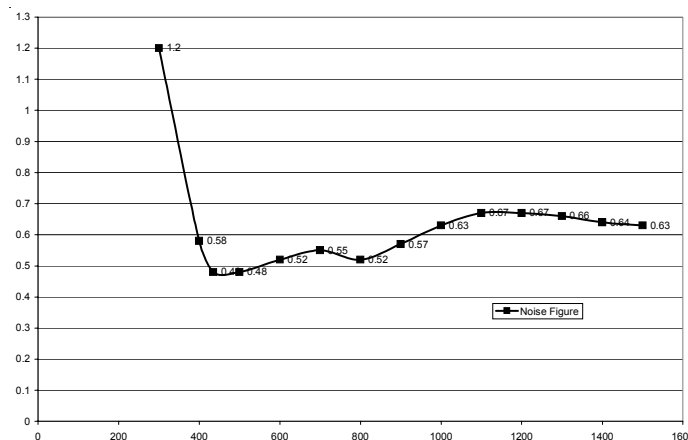


Figure 4: Detailed noise figure graph.



At the labs of CNS Systems, Inc. in MD (W2GPS's business), W2GPS, W3IWI and N4HY finished cobbling together the SDR prototype transponder today (8/16/05). We successfully conducted a three way QSO using the 45 KHz wide Mode A transponder. Mode B, software selectable, will be added during the coming week on a trip to Down East Microwave.

The SDR transponder is based on the software designed and written by AB2KT, Frank Brickle, AMSAT's newest member and a serious polymath, along with Bob, N4HY. We have been concentrating on the SDR-1000 as most nearly fitting our early needs. Today's prototype demonstration was done using two SDR-1000's (see <http://www.flex-radio.com>)

For the software used in today's first success please see:

<http://dtts.sourceforge.net>

This is not the latest code. The latest code, along with the fully functional transponder code will be uploaded as soon as Frank and I argue about the directory structure and fix a few gotcha's that can only be found out by trying the code!

For the hardware, we used two SDR-1000's and a DEMI transverter for 2 meters. This coming week, Bob, N4HY, will travel to DEMI and 70 cm will be added.

At the AMSAT annual meeting in Louisiana, we will have both the Mode B and the Mode A transponder fully functional and usable by all. We will show the power of using a software defined radio for the transponders by having 1/2 of the transponder divided into two or three FM channels and the other half fully linear whilst adding 400bps AMSAT standard beacon in the middle, AND on command, switch it to fully linear, etc. Given today's success we will proceed with development of fully functional SDR equipment that can be adapted to multiple missions that MIGHT be flyable on Phase 3E but will absolutely be on AMSAT Eagle.

We will incorporate the Stella algorithms developed by Howard, G6LVB, adapted to our hardware for the demonstration in Louisiana. Expect to be able to conduct SSB, CW, FM, etc. QSO's on Mode A, Mode B and Mode LS if time permits (see next paragraph).

If time permits, we will also be attempting to use GnuRadio USRP, with its dedicated



On Tuesday, August 16, 2005, Tom Clark, W3IWI, Rick Hambly, W2GPS, and Bob McGwier, N4HY, (left to right in the picture) made the first ever live contacts via the prototype Eagle satellite Software Defined Transponder (SDT). The SDT software was written by Frank Brickle, AB2KT, and Bob McGwier, N4HY. The transponder was set up in Rick's lab (shown) and the contacts were made from Rick's ham shack, completely independent of the lab.

L band receiver and S band transmitter module for an LS transponder. This will be possible only if the S band module is available and functional in time for us to develop the software for the USRP.

<http://n4hy.smugmug.com/gallery/736793>

(The jumble of wires will disappear by Louisiana. If not, we might trip over them!)

Thanks to Rick and Elaine Hambly for allowing this to go on for weeks.

It is hoped that with this demonstrated versatility, it will be easily understood why SDR is an important technology for AMSAT to be using. Karl Meinzer, DJ4ZC, is an early adopter of SDR technology for spacecraft. For Phase 3E, the telecommand uplinks will be a software defined radio receiver. In addition to the standard telecommand link, we will be using a Turbo code based system licensed by AMSAT-DL for use on the Phase 3E spacecraft to test its efficacy for Karl's and AMSAT-DL's great dream: P5A, a mission to Mars.

To make this possible, AMSAT-DL has been getting some design and software work done by Lyle Johnson, KK7P, Chuck Green, N0ADI, Frank Brickle, AB2KT, and Bob N4HY. We worked together for several days at the home and offices of KK7P on the IHU-3. The IHU-3 test code came up and ran and Bob, N4HY is very close to having IPS

running on the IHU-3 (expect that announcement to be made from AMSAT-DL in a few days after we get a few bugs worked out).

<http://n4hy.smugmug.com/gallery/727464> (These photos are by N0ADI and N4HY.)

and you may visit the AMSAT-DL IHU meeting photo's at:

<http://n4hy.smugmug.com/gallery/383989>

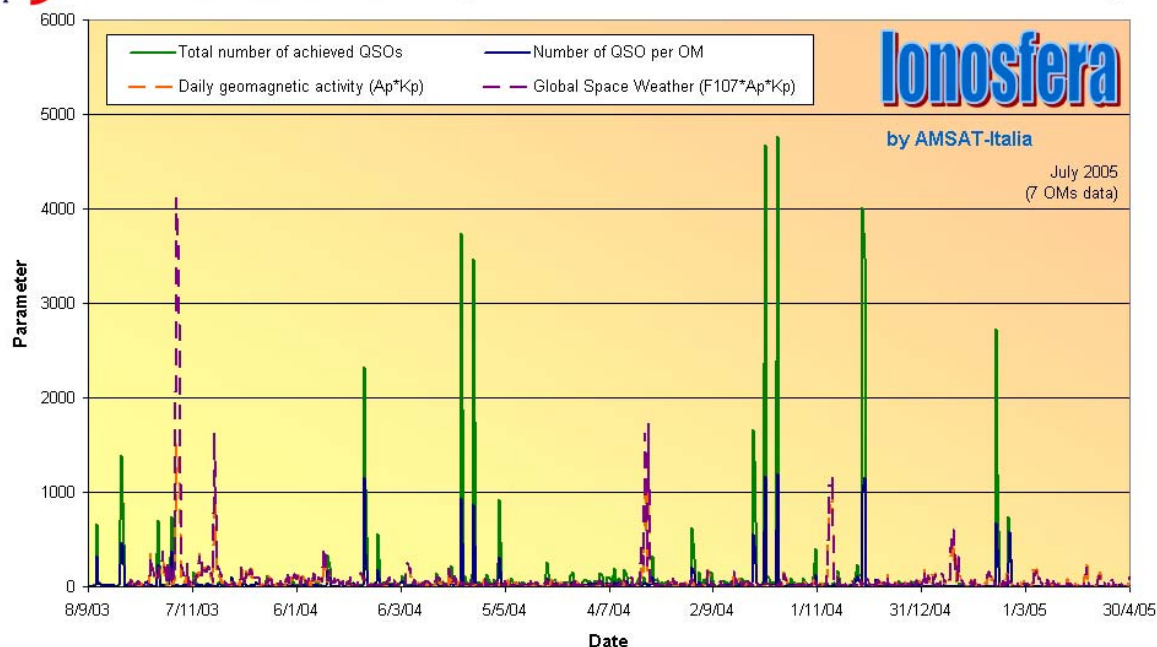
A MUCHSIMOS GRACIAS goes out to Heather Johnson for putting up with this group for several days while we prepared an IHU-3 for radiation testing by Stacey Mills, W4SM.

A paper by Lyle Johnson, Chuck Green and Bob has been prepared for the annual meeting. The annual meeting in Louisiana is shaping up to be one on demonstrable achievement on all sides of the AMSAT world. I hope to see you there.

73,
Bob, N4HY ☺



Space Weather and Radioamateur HF DX Activity



The graph shown here above is the latest result of the on-going “Ionosfera” project conducted by AMSAT-Italia for the European Space Agency (ESA) and ... for the worldwide radio amateur DX community.

The chart presents strong de-correlation between HF DX activity (represented by the number of achieved QSOs) and “Space Weather” propagation via ionosphere seems indeed to be poor when Space Weather is stormy and inversely, is ensured in the case of a quiet Sun-Earth context.

“Space Weather” is the name of the emerging science investigating the various Sun-Earth interactions and their effects on human activities and systems. In the present case (see graph), it is represented by solar activity (through the famous “F10.7” flux index) and the geomagnetic behavior (indicated by the “Ap” and “Kp” indexes).

Space Weather, for many applications, can be compared with the “classical” (terrestrial) meteorology. Its study is of primary importance (for us) as it allows for the prediction of the ionospheric propagation conditions.

Thanks to its long and recognized interest for this topic, AMSAT-Italia, in the name of the whole AMSAT community, succeeded in approaching the European Space Agency (ESA) and proposing the “Ionosfera” study/service in the framework of ESA’s current activities on Space Weather.

Ionosfera is a Web-based collection of (free of charge) tools for HF DX activity and can be visited at <http://esa-spaceweather.net/sda/ionosfera/index2.htm>.

The present article is then an invitation to use and or collaborate with Ionosfera by looking at the Web site, review/comment on it and by sending us as many HF DX log files as you can collect. Logs should cover the 1st of September 2003 – 30th of April 2005 period. Thank you! Please send us your comments (additional info on the topic, suggestions on how to improve/complement) and log files at iw2nmb@amsat.org

TNX and best 73s

Florio, IW2NMB

Coordinator, AMSAT (Italia) of the Ionosfera project ☎



Sky Survey

by Dee Interdonato, NB2F, nb2f@amsat.org

Did you ever do a sky survey? No, not gazing at the stars. What I'm talking about is surveying your QTH to see how it stacks up at "seeing" the satellites. When I decided (many moons ago) to get active on amateur satellites, I checked my HF antenna experience at my front door. Satellites are traveling at various azimuths relative to your QTH and as a general rule, average less than 40 degrees elevation on any given day. I took a day's worth of passes for usable satellites and came up with slightly less than 25 degrees elevation as an average for that day (north Jersey). Now, there are passes that come closer to overhead, but with a LEO satellite, any DX communications that might be possible are enhanced with lower elevation passes. This is relative to the "footprint" of the satellite - its actual area of usable communications at the time the satellite is in view.

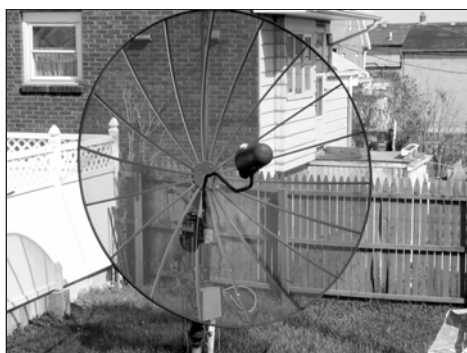


Figure 1: Dee's ground-mounted TVRO dish.

LEO Satellites average a height of 300 miles and an HEO (at apogee) height of 27,000 miles. Now, 50 feet is not going to make a difference here on earth, feed line loss not counting. As the frequencies move into the GHz range, visibility is more important than getting your satellite antenna 50 feet closer to the bird.

I have operated satellites since the early 80's and had my antennas on my roof that could "see" above 5 degrees in all directions. At the time I did my initial formal sky survey, I was concentrating on AO-40. I had acquired a nice used 10 foot dish that I was going to make my show stopper for this bird, especially since 2.4 GHz was the only usable downlink after all was said and done. I checked the passes and found that azimuths between approximately 85 degrees and 270 degrees were the windows that were open to me for this bird. Living in a not so rural

area of north Jersey, I had clutter to deal with, i.e., buildings that surrounded my property. I managed to put up the dish with homebrew AZ and EL systems. I could look out my window to get the actual status. "Trim" pointing is what I called it - getting near the actual AZ/EL and nudging the antenna until the signal peaked as the beamwidth of dishes this large are narrow.

You can estimate the look angle of an antenna location by using a simple level and protractor. Walk your property and determine the minimum angle for your horizon limitations - artificial (buildings, etc.) or natural (hills, etc., and don't forget that trees grow leaves!) - at all points of the compass. I have a large school on the next block that limits my ground site to 15 degrees toward the north for about 30 degrees of azimuth and my own home limits my view (Figure 3) from about 280 to about 320



Figure 2: Roof-mounted antennas.

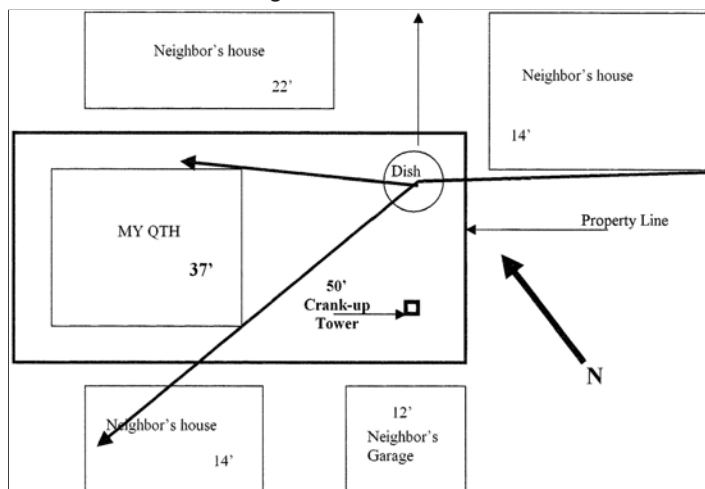
degrees azimuth and 35 degrees elevation. With AO-40 super reception in mind, I mounted my dish in a corner area of the yard (Figure 2) at ground level that would allow 95% of those passes to be accessible to my station. Fortunately, my house is a two family type and is high enough for my regular satellite antennas to overcome the ground limitations but the nearby school still limits me to the north with about 5 degrees elevation. My normal VHF/UHF antennas are roof mounted (Figure 2) - 144 MHz, 435

MHz, 1.2 GHz, and 2.4 GHz beams. Remember, you are shooting for horizon-to-horizon passes for full use of the satellites. This is, of course, an ideal QTH setup. As I have, settling for what you are given to work with is more the case. I used the dish to receive AO-40 and the roof UHF Yagi to transmit. This worked out well since AO-40 hung in position for hours in the HEO orbit. I look forward to Phase 3E and Eagle to give me similar results. I plan to use the 10-foot dish for some future experiments on 1.2 GHz and other higher frequencies on yet to be launched satellites.

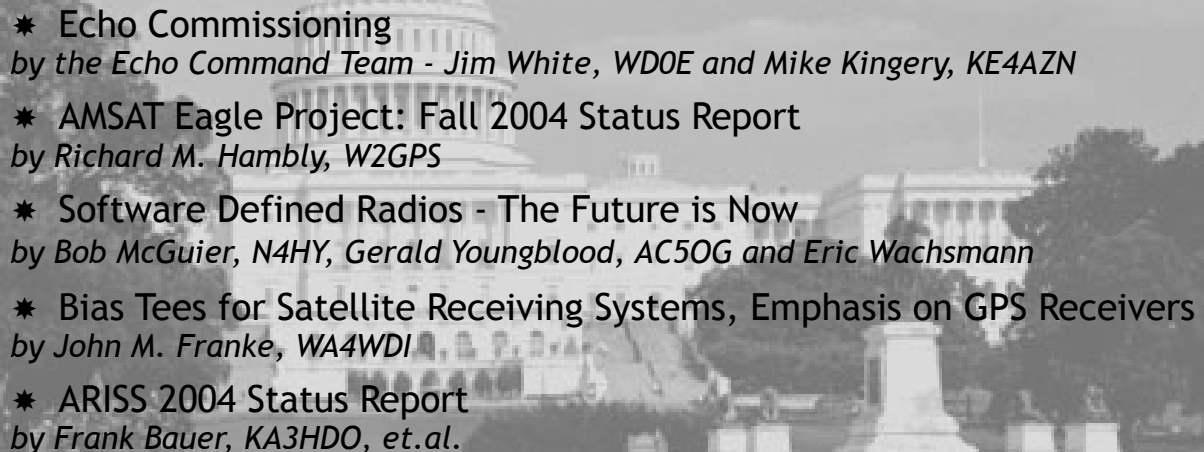
Don't forget that you must do the calculations supplied by the ARRL for RF exposure hazards. There are limits of exposure to humans at certain distances from the antennas, depending on power and frequency. Ground mounting creates human exposure problems since people are more easily exposed at ground level. I was trained and instructed on these hazards at the WTC transmitter site having to do radio maintenance there before 9/11. There were areas on the roof there that, without an RF suit, one couldn't even venture into.

Please check your local zoning regulations for TVRO dishes. I was ordered to take my dish down for failure to apply for a permit for a TVRO antenna. This only pertained to a ground-mounted dish and had I put it on my roof (ugly??), there were no requirements. I squeaked by as this was NOT a TVRO antenna, it was an Amateur Radio antenna and there were NO regulations in my town for Amateur Radio antennas. I showed the town fathers PRB-1 as they needed to be educated on this. It also helped

Figure 3: NB2F horizon limitations.



Contents include articles on Echo, Eagle, ARISS, Ground Station User Equipment, University Satellites and much more! For example:

- 
- * **Echo Commissioning**
by the Echo Command Team - Jim White, WD0E and Mike Kingery, KE4AZN
 - * **AMSAT Eagle Project: Fall 2004 Status Report**
by Richard M. Hambly, W2GPS
 - * **Software Defined Radios - The Future is Now**
by Bob McGuier, N4HY, Gerald Youngblood, AC5OG and Eric Wachsmann
 - * **Bias Tees for Satellite Receiving Systems, Emphasis on GPS Receivers**
by John M. Franke, WA4WDI
 - * **ARISS 2004 Status Report**
by Frank Bauer, KA3HDO, et.al.

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To sum it all up, do your homework on your QTH. Make a sensible decision on satellite antennas even if it is a compromise. I had to make my decision for my needs but I used this survey technique to optimize my antenna location. 🇺🇸

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Be sure to indicate that you are with AMSAT in order to qualify for the special room rate.

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Lafayette Regional Airport (LFT) is serviced by Delta, Continental and Northwest Airlines. Connections to LFT are through Houston, Dallas/Fort Worth, Memphis and Atlanta. For more information visit the Lafayette Regional Airport website. More direct flights are available to Baton Rouge, approximately 60 miles from Lafayette and New Orleans, approximately 130 miles away.

Train and Bus:

Lafayette is serviced by AMTRAK and is a stop on the Sunset Limited (Los Angeles to Orlando.) Trains run east and west approximately every 3 days. Lafayette is also serviced nationally by Greyhound.

The Lafayette Transit System (LTS) runs local bus service from 6:30am to 11:30pm. Fares generally run \$0.75 for adults and there are child and senior discounts. A day pass is available for \$2.00 per day.

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A Field Day Gathering

The Paso Robles radio club asked for satellite support from the Cal Poly CUBESAT group during the June 2005 ARRL Field Day event. Here are two representative pictures of that event. Figure 1 shows Jessica Hovdesven, KG6YNZ, aiming the Arrow antenna while Cliff, K7RR, attempts contact. In the background is a 40 meter discone antenna erected especially for Field Day. Of course this is a bit of overkill for the ten-meter AO-07 downlink but it worked rather well for the remaining portion of Field Day!

Figure 2 shows Cliff Buttschardt, K7RR, operating as a single operator on the satellites. The rigs were an FT-847 and an FT-726 working as stand alone transceivers which well illustrated how manual tracking can be done. Computer Doppler control works so much better by comparison! Battery power was used simulating emergency conditions.

73,
Cliff, K7RR, July 2005

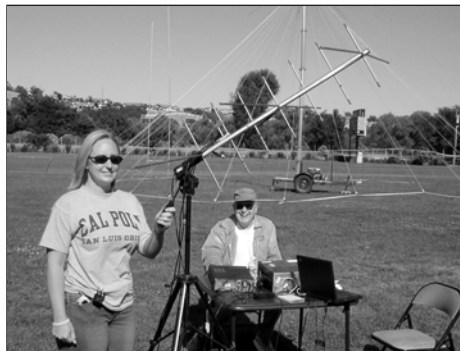


Figure 1: Jessica aims the Arrow while Cliff works the bird.



Figure 2: Cliff and his meager 40M satellite antenna.

... from page 5

Examples of QRP stations worked on 432 MHz EME by HB9Q:

Call	Antennas	Power (W)	Mode	Comment	on sked
OE3FVU	1x38	35	JT65C	1. EME QSO, best -25	
RW1AY/1	1x7wl	50	JT65C	1. EME QSO, best -29	
OH1JCS	1x21	50	JT44	1. EME QSO, best -23	
OK1TEH	1x23	50	JT65C	1. EME QSO, best -27	x
W7IUV	1x33	50	JT65C	1. EME QSO, best -24	
K7AD	1x33	50	JT65C	1. EME QSO, best -28	
ZS5LEE	2x22	50	JT44	1. EME QSO, best -23	
ON4DPX	2x26	50	JT44	1. EME QSO, best -23	x
JJ3JHP	4x21	50	CW	1. EME QSO, "O"	x
KD3UY	1x28	60	JT44	1. EME QSO, best -25	
W2WD	1y	60	JT65C	Random QRP that day, best -28	
UA4AQL	2x24	70	JT44	1. EME QSO, best -24	x
OM3WBC	2x12	75	JT65C	1. EME QSO, best -23	
EA6VQ	1x21	80	JT65C	1. EME QSO, best -28	
WB2SIH	1x19	90	JT44	1. EME QSO, best -24	
ZS5Y	1x8.5wl	90	JT44	1. EME QSO, best -20	
IW5DHN	1x29	90	JT44	1. EME QSO, best -24	x
PY2SRB	1x21	100	JT65C	1. EME QSO, best -28	
SV8CS	1x21	100	JT65C	1. EME QSO, best -27	
F6FHP	1x21	100	JT44	1. EME QSO, best -22	x
VK4CDI	1x22	100	JT65C	1. EME QSO, best -28	x
K7MAC	1x32	100	JT65C	1. EME QSO, best -23	



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Gold, Silver, Bronze and Core levels are available to match your ability to participate.



Cash Gifts

Visa or MasterCard or checks are accepted. And, you can specify how your contribution is to be used.



Gift of Life Insurance

US taxpayers may be able to receive a significant income tax deduction by making The Radio Amateur Satellite Corporation the owner and beneficiary of life insurance policies.



Gift of Stocks or other Securities

US taxpayers should be able to avoid gains taxes on appreciated securities and receive a deduction for their fair market value.



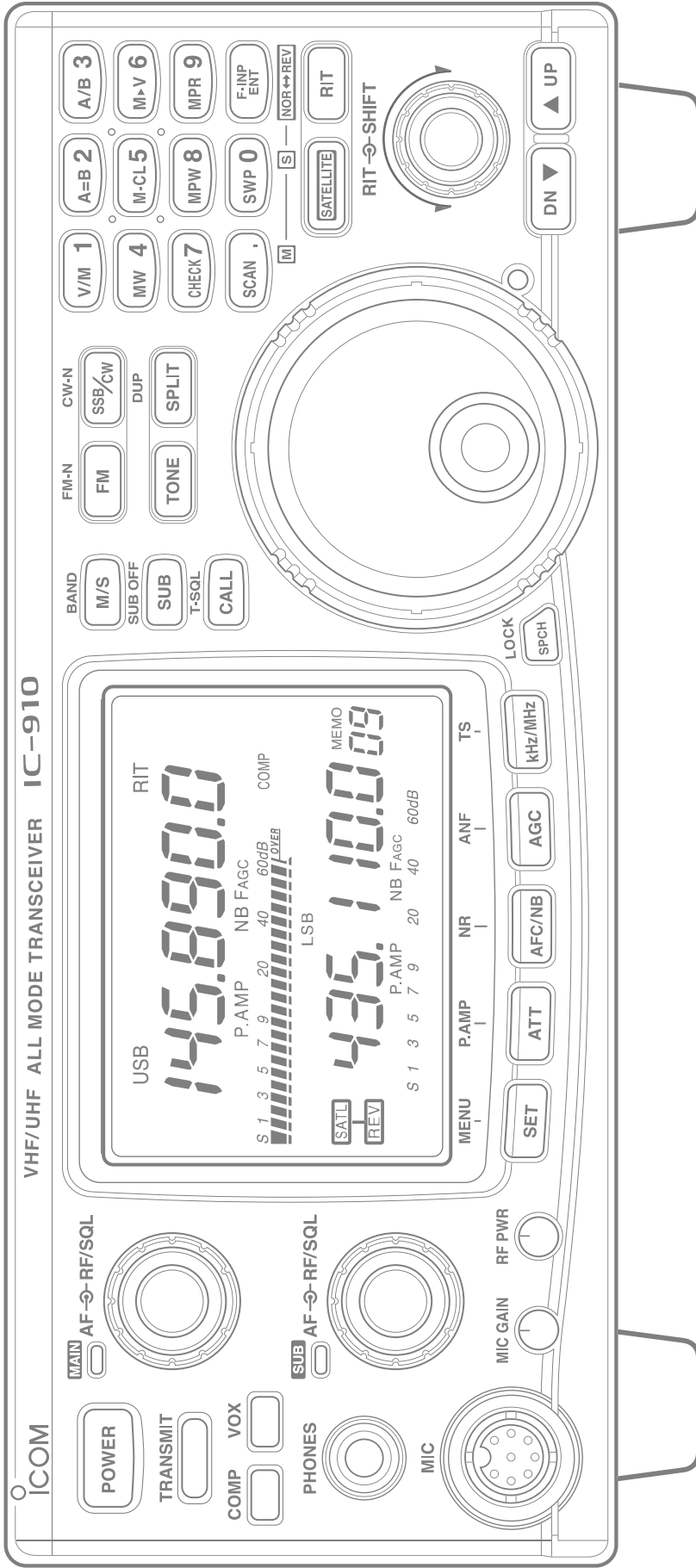
Bequest

A codicil in your will, naming The Radio Amateur Satellite Corporation as a beneficiary, will help insure the continuance of the Amateur Radio Satellite program.

Call the AMSAT-NA office at 301-589-6062 for questions on any or all of these ways you can help build new and exciting satellites.

Support AMSAT-NA





910H. Actual Size (Space is infinite. Your shack is not).

Don't let the size fool you, there's never been a rig bred more specifically for satellite ops. A big-screen, dual-frequency readout sets the scene while smooth Doppler compensation lets you follow the action. With .11µV sensitivity and true dual tracking VFO's. Add optional down converters, pre-amps and DSP for an almost complete off-the-shelf system. But the sky is not the limit with the 910H. For terrestrial operation, it more than delivers everything you need. Whether you're working FM repeaters, or tracking the newest satellite, the 910H puts you in command. See your authorized Icom dealer.

100W Variable Output • All Mode • Simultaneously Works Two Bands at Once • 9600 bps High Speed PACKET Port • .11 µV Sensitivity • Main & Sub Band Functions for IF Shift, Sweep, NB, RF Attenuator • Large LCD Display • Four Versatile Scanning Functions • CTCSS Encode/Decode/Tone Scan - Even in Satellite Mode! • Built-in Keyer • PC Controllable • Memory Pad • Normal/Reverse Satellite Tracking • Size (approx): 9.5" W x 3.687" H x 9.437" D • Weight: 9.5 lbs.

AG-2400 Downlink Receive Converter

Converts a 2400MHz RF signal to a 144MHz IF signal, allowing US mode operation. Use with optional UX-910, for LS mode operation.

AG-25 144MHz AG-35 430MHz Preamplifiers

External all-weather, mast mounting preamplifiers. Compensates for cable loss.

UT-106 DSP Unit

AF-DSP functions, including noise reduction and automatic notch filter. Use two, one for main band & one for sub-band.

UX-910 1200MHz Band Unit

Turns the IC-910H into an all mode, tri-band transceiver. Also makes crossband and full duplex operation possible.

Accessories